

No. 1558

## MEMORANDUM OF AGREEMENT

BETWEEN THE

## DEPARTMENT OF PUBLIC WORKS

AND THE TOWN OF

SOUTHBOROUGH

relating to work to be done under the provisions of Sections 26-29, Chapter 81 of the General Laws, as amended.

Date, July 2, 1929

Allowment, \$ 4,800

Town's Contribution, \$ 7,200

Approved,

Cost, \$

OFFICE OF

Department of Public Works

STATE HOUSE,  
BOSTON, MASS.



*The Commonwealth of Massachusetts  
Department of Public Works*

Room 413, State House,  
Boston Mass.,  
July 2, 1929.

To the Board of Selectmen,  
**Southborough, Mass.**

Gentlemen:

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Herewith please find a copy of contract No, 1558 covering work to be done in your town this year under the provisions of **Sections 26-29, Chapter 81** of the General Laws, as amended.

This contract has been signed by the Commissioners and by your Board.

If the work has not already been started, please notify the District Highway Engineer, **J. A. Johnston, 476 Main St., Worcester.**

when you will be ready to begin work.

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Yours truly,

*Mayo A. Riley*  
Secretary

Copy to Dist. Hy. Eng.

R-E

*Southboro*



## The Commonwealth of Massachusetts

## DEPARTMENT OF PUBLIC WORKS

**Memorandum of Agreement** between the Commonwealth of Massachusetts, by the Department of

Public Works, and the Town of **SOUTHBOROUGH**, in the County  
of **WORCESTER** by its Board of Selectmen, duly authorized (hereinafter referred

to as the Contractor), relating to the repair and improvement of the public ways in said town under the provisions of Sections 26-29, Chapter 81 of the General Laws, as amended by Chapter 281 of the Acts of 1922 and by Chapter 315 of the Acts of 1926.

In consideration of the payments hereinafter mentioned to be made to said town of **SOUTHBOROUGH**  
by the Commonwealth of Massachusetts, the Selectmen of said town hereby agree  
to do work to the value of **TWELVE THOUSAND DOLLARS (\$12,000.00)**

in the repair, maintenance and improvement of the public ways in said town (exclusive of State highways) for which the Selectmen of said town petitioned the Department of Public Works under date of

**May 6, 1929,**

the work to be done subject to the following conditions, *viz.:*

Such roads or portions thereof as may be designated by the Engineer of the Department of Public Works shall be widened, reshaped, or surfaced with gravel or other suitable material; brush shall be cut, culverts and catch basins shall be built, stone filling shall be furnished in place; and road scrapers and road drags shall be used in the maintenance of said roads.

The work shall be done at such time and in such manner as the Engineer may direct, and after the work is ordered there shall be no delay therein or cessation thereof until such work is completed. Any unnecessary delay or cessation of work after the work has been ordered by the Engineer may be considered by the Department of Public Works sufficient cause for annulling this contract, unless such delays or cessation of work are due to unavoidable circumstances. No materials, supplies, machinery or tools shall be purchased for said work without the consent and approval of the Engineer. All of the work done and all of the materials furnished under this contract shall be to the satisfaction of the Department of Public Works.

The Contractor, in the construction of the work herein contracted for, in the employment of mechanics, teamsters and laborers, shall give preference first, to citizens of the Commonwealth who have served in the army or navy of the United States in time of war and have been honorably discharged therefrom or released from active duty therein, and who are qualified to perform the work to which the employment relates; and secondly, to citizens of the Commonwealth generally, and, if they cannot be obtained in sufficient numbers, then to citizens of the United States. The wages for a day's work paid to mechanics and teamsters employed in the construction of public works as aforesaid shall be not less than the customary and prevailing rate of wages for a day's work in the same trade or occupation in the locality, city or town where such public works are constructed. Any contractor who knowingly and wilfully violates the provisions of this section shall be punished by a fine of not more than one hundred dollars for each offense.

No laborer, workman or mechanic working within the Commonwealth, in the employ of the Contractor, sub-contractor or other person doing or contracting to do the whole or a part of the work contemplated by this contract, shall be required or permitted to work more than eight hours in any one day or more than forty-eight hours in any one week, except in cases of extraordinary emergency. The Department or the Contractor or any sub-contractor may employ laborers, workmen and mechanics for more than eight hours in any one day in the construction or reconstruction of the highways covered by this contract when in the opinion of the Commissioner of Labor and Industries public necessity so requires. Every employee in the work covered by this contract shall lodge, board and trade where and with whom he elects, and neither the Contractor nor his agents or employees shall directly or indirectly require as a condition of employment therein that an employee shall lodge, board or trade at a particular place or with a particular person.

The Contractor shall comply with the provisions of Chapter 149 of the General Laws as amended by Chapter 517 of the Acts of 1922 relative to giving such preference to citizens in awarding contracts for public work as is therein provided.

The Contractor shall also keep fully informed of all existing and future state and national laws and municipal ordinances and regulations in any manner affecting those engaged or employed in the work, or the materials used in the work, or in any way affecting the conduct of the work, and of all such orders and decrees of bodies or tribunals having any jurisdiction or authority over the same. The Contractor shall at all times observe and comply with, and shall cause its agents and employees to observe and comply with, all such existing and future laws, ordinances, regulations, orders and decrees; and shall protect and indemnify the Commonwealth, the Department, the Engineer and all of its and their officers and agents and servants against any claim or liability arising from or based on the violation of any such law, ordinance, regulation, order or decree, whether by said Contractor or its employees or sub-contractors.

Daily report cards, pay roll sheets, and forms for showing the cost of materials and tools bought, will be furnished by the Department of Public Works. The report cards shall be filled out daily, shall show the total cost of each day's work on each road, and shall be signed by the foreman in charge of the work. The pay roll forms shall show the cost of all labor, teams, etc., for each pay roll period, and the total cost shall conform to the amounts shown on the daily report cards for that period. The pay roll sheets shall show the amount paid to each individual; if the individual receives cash, his signature shall appear on the pay roll, showing that he has been paid, or if a check is drawn by the Town Treasurer for each individual, the number of the check entered against each amount will be equivalent. The pay roll sheet must receive "Departmental Approval" by the signature of the foreman or superintendent who makes out the pay roll for the men under his supervision, and "Accounting Approval" by the Selectmen drawing the order, or by the Town Treasurer. Forms showing the cost of materials, tools, etc., bought, shall be signed by the foreman who receives the material and by the Chairman of Selectmen or the Selectman who draws the order therefor.

On the completion of the work called for by this contract to the satisfaction of the Department of Public Works, or at intervals before the completion of the work if the selectmen so request and the Engineer recommends, the Commonwealth of Massachusetts, by said Department of Public Works, will pay or cause to be paid

to said town of **Southborough two-fifths of** the

value of the work so done, based on the actual cost of the materials furnished and of the labor and teams employed in the performance of said work, as shown by the daily report cards, pay roll sheets, and forms showing the cost of materials, tools, etc., bought, properly filled out, signed and submitted to the District Highway Engineer of the Department of Public Works or his duly authorized assistant, the prices to be paid for labor and teams being the current prices in the locality; provided, however, that the total amount to be paid by the Commonwealth to said town under this contract shall not exceed the sum of

**FOUR THOUSAND EIGHT HUNDRED DOLLARS (\$4,800.00)**

being the amount of the allotment granted to said town, for the said work, by a vote of said Department of Public Works dated **May 14, 1929** ; the cost in excess of the payments herein provided to be paid by said town of **Southborough**.

IN WITNESS WHEREOF, the parties of this agreement have hereunto set their hands this

**Second** day of **July**, **, A. D. 1929,**

THE COMMONWEALTH OF MASSACHUSETTS,

By .....

*MacDonald*  
*Rubert H. Haze*

Department  
of  
Public Works.

TOWN OF **SOUTHBOROUGH,**

By .....

*Chas. F. Cloak*  
*W. M. Proctor*  
*Charles O. Masson*

Board  
of  
Selectmen  
duly  
authorized.

APPROVED: .....

*F. E. Garrison*  
Commissioner of Public Works.

No. 2246

**MEMORANDUM OF AGREEMENT**

BETWEEN THE

**DEPARTMENT OF PUBLIC WORKS**

AND

**SOUTHBOROUGH**

relating to certain work to be done  
in Southborough  
under the provisions of Section 34,  
Chapter 90, of the General Laws,  
as amended.

Date, July 17, 1928

Allotment, \$ 10,000.00

Approved,

*Stations,*

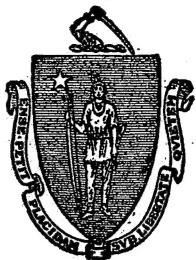
*Feet.*

*Cost, \$*

OFFICE OF

**DEPARTMENT OF PUBLIC WORKS**

STATE HOUSE BOSTON, MASS.



## The Commonwealth of Massachusetts

## DEPARTMENT OF PUBLIC WORKS

**Memorandum of Agreement** between the Commonwealth of Massachusetts, by the Department of Public Works, and the Town of **SOUTH BOROUGH**,  
in the county of **WORCESTER**, by its Board of Selectmen, duly authorized (hereinafter referred to as the Contractor), relating to the improvement of a section of road in said town under the provisions of Section 34, Chapter 90 of the General Laws, as amended by Chapter 112 of the Acts of the year 1921 and by Chapter 288 of the Acts of the year 1925.

In consideration of the payments hereinafter mentioned to be made to said town of **SOUTH BOROUGH** by the Commonwealth of Massachusetts, the Selectmen of said town hereby agree to **grade, surface with bituminous macadam and otherwise improve about 2,850 feet** of the road in said town ~~for improvement of which the Selectmen of said town petitioned the Department of~~ Public Works under date of **April 20, 1928**;

said road **leading from Southborough to Framingham, and being locally known as the Framingham Road,**

the work to begin **at a point about 1,400 feet north of East Main Street, station 84+50, and extend in a southerly direction to station 113,**

subject to the following conditions, viz.:—

First: The work shall be done in accordance with and as specified in a contract between the Town of SOUTHBOROUGH, by its Board of Selectmen, and H. & J. P. Green Company, of Worcester, executed under date of June 1, 1928, on file in the office of the Department of Public Works; said contract being hereby made a part of this agreement. The specifications contained in said contract shall have the same force and effect as if written herein at length.

Suitable guard rail shall be built where, in the opinion of the Selectmen, such a safeguard is necessary to protect travelers on the highway.

All of the work done and all of the materials furnished under this contract shall be to the satisfaction of the Department of Public Works.

On the completion of the work hereinbefore described, all rubbish and debris shall be removed from the roadway and the roadsides, and the whole work shall be left neat and presentable.

The Contractor, in the construction of the work herein contracted for, in the employment of mechanics, teamsters and laborers, shall give preference first, to citizens of the Commonwealth who have served in the army or navy of the United States in time of war and have been honorably discharged therefrom or released from active duty therein, and who are qualified to perform the work to which the employment relates; and secondly, to citizens of the Commonwealth generally, and, if they cannot be obtained in sufficient numbers, then to citizens of the United States. The wages for a day's work paid to mechanics and teamsters employed in the construction of public works as aforesaid shall be not less than the customary and prevailing rate of wages for a day's work in the same trade or occupation in the locality, city or town where such public works are constructed. Any contractor who knowingly and willfully violates the provisions of this section shall be punished by a fine of not more than one hundred dollars for each offence.

No laborer, workman or mechanic working within this Commonwealth in the employ of the Contractor, sub-contractor or other person doing or contracting to do the whole or a part of the work contemplated by this contract shall be required or permitted to work more than eight hours in any one day or more than forty-eight hours in any one week, except in cases of extraordinary emergency. The Department or the Contractor or any sub-contractor may employ laborers, workmen and mechanics for more than eight hours in any one day in the construction or reconstruction of the highway covered by this contract when in the opinion of the Commissioner of Labor and Industries public necessity so requires. Every employee in the work covered by this contract shall lodge, board and trade where and with whom he elects, and neither the Contractor nor his agents or employees shall directly or indirectly require as a condition of employment therein that an employee shall lodge, board or trade at a particular place or with a particular person.

The Contractor shall comply with the provisions of Chapter 149 of the General Laws as amended by Chapter 517 of the Acts of 1922 relative to giving such preference to citizens in awarding contracts for public work as is therein provided.

The Contractor shall also keep fully informed of all existing and future state and national laws and municipal ordinances and regulations in any manner affecting those engaged or employed in the work, or the materials used in the work, or in any way affecting the conduct of the work, and of all such orders and decrees of bodies or tribunals having any jurisdiction or authority over the same. The Contractor shall at all times observe and comply with, and shall cause its agents and employees to observe and comply with, all such existing and future laws, ordinances, regulations, orders and decrees; and shall protect and indemnify the Commonwealth, the Department, the Engineer and all of its and their officers and agents and servants against any claim or liability arising from or based on the violation of any such law, ordinance, regulation, order or decree, whether by said Contractor or its employees or sub-contractors.

On the completion of the work called for by this contract to the satisfaction of the Department of Public Works, or at intervals before the completion of the work if the Selectmen so request and the Engineer recommends, the Commonwealth of Massachusetts, by said Department of Public Works, will pay or cause to be paid to said Town of **Southborough** **one-third of** the value of the work so done, based on the actual cost of the materials furnished and on the actual prices paid for labor and teams employed in the performance of said work, as shown by the Selectmen's paid vouchers and itemized bills, and by estimates approved by the District Highway Engineer of the Department of Public Works or his duly authorized assistant, the prices to be paid for labor and teams being the current prices in the locality; provided, however, that the total amount to be paid by the Commonwealth to said Town under this contract shall not exceed the sum of

TEN THOUSAND DOLLARS (\$10,000.00)

being the amount of the allotment granted to said Town, for the said work, by a vote of said Department of Public Works dated **April 24, 1928**; the cost in excess of the payments herein provided to be borne by said Town of **Southborough**.

The Selectmen agree that the section of road covered by this contract will be kept by the Town at all times in good repair and condition as provided by Section 25, Chapter 81 of the General Laws, as amended by Chapter 428 of the Acts of the year 1921.

IN WITNESS WHEREOF, the parties to this agreement have hereunto set their hands this seventeenth day of July, A. D. 1928.

THE COMMONWEALTH OF MASSACHUSETTS

By William F. Williams  
Vachan K. Hale  
John Green

*Department  
of  
Public Works.*

**TOWN OF SOUTHBOROUGH.**

By George F. Peckel  
Sebas. M. Peckel

*Board  
of  
Selectmen  
duly  
authorized.*

APPROVED: \_\_\_\_\_

William F. Kildani  
Commissioner of Public Works.

No. 2451

MEMORANDUM OF AGREEMENT

BETWEEN THE

DEPARTMENT OF PUBLIC WORKS

AND THE TOWN OF

SOUTHBOROUGH.

relating to work to be done under  
the provisions of Sections 26 — 29,  
Chapter 81, of the General Laws.

Date, July 10, 1934.

Allotment, \$ 6,750.00

Town's Contribution \$ 6,750.00

Approved,

Cost, \$

OFFICE OF  
DEPARTMENT OF PUBLIC WORKS

100 NASHUA STREET BOSTON, MASS.



## The Commonwealth of Massachusetts

### DEPARTMENT OF PUBLIC WORKS

**Memorandum of Agreement** between the Commonwealth of Massachusetts, by the Department of Public Works, and the Town of **SOUTHBOROUGH**, in the County of **Worcester** by its board of Selectmen, duly authorized (hereinafter referred

to as the Contractor), relating to the repair and improvement of the public ways in said town under the provisions of Sections 26-29, Chapter 81 of the General Laws, Ter. Ed., **as amended by Chapter 366, Acts of 1934.**

In consideration of the payments hereinafter mentioned to be made to said town of **Southborough** by the Commonwealth of Massachusetts, the Selectmen of said town hereby agree to do work to the value of **THIRTEEN THOUSAND FIVE HUNDRED DOLLARS (\$13,500.00)**

in the repair, maintenance and improvement of the public ways in said town (exclusive of State highways) for which the Selectmen of said town petitioned the Department of Public Works under date of

**June 4, 1934.**

**the work to be done subject to the following conditions, viz.:**

Such roads or portions thereof as may be designated by the Engineer of the Department of Public Works shall be widened, reshaped, or surfaced with gravel or other suitable material; brush shall be cut, culverts and catch basins shall be built, stone filling shall be furnished in place; and road scrapers and road drags shall be used in the maintenance of said roads.

The work shall be done at such time and in such manner as the Engineer may direct, and after the work is ordered there shall be no delay therein or cessation thereof until such work is completed. Any unnecessary delay or cessation of work after the work has been ordered by the Engineer may be considered by the Department of Public Works sufficient cause for annulling this contract, unless such delays or cessation of work are due to unavoidable circumstances. No materials, supplies, machinery or tools shall be purchased for said work without the consent and approval of the Engineer. All of the work done and all of the materials furnished under this contract shall be to the satisfaction of the Department of Public Works.

Rules, regulations and orders adopted under clause (17) of section 22 of chapter 7 of the General Laws, as appearing in the Tercentenary Edition thereof, shall, so far as may be approved by the Governor and Council, apply to the purchase of supplies and materials in the execution of this contract. (St. 1933, ch. 353, sec. 2). These rules require a preference in the purchase of supplies and materials, other considerations being equal, in favor, first, of supplies and materials manufactured and sold within the Commonwealth, and second, of supplies and materials manufactured and sold within the United States.

Every employee in the work covered by this contract shall lodge, board and trade where and with whom he elects, and neither the Contractor nor his agents or employees shall directly or indirectly require as a condition of employment therein that an employee shall lodge, board or trade at a particular place or with a particular person. (Sec. 25, Chap. 149, G. L., Ter. Ed.)

The Contractor, in the work herein contracted for, in the employment of mechanics, teamsters, and laborers, shall give preference first, to citizens of the Commonwealth who have served in the army or navy of the United States in time of war and have been honorably discharged therefrom or released from active duty therein, and who are qualified to perform the work to which the employment relates, and secondly, to citizens of the Commonwealth generally, and, if they cannot be obtained in sufficient numbers, then to citizens of the United States. (Sec. 26, Chap. 149, G. L., Ter. Ed.)

No laborer, workman or mechanic working within the Commonwealth, in the employ of the Contractor, sub-contractor or other person doing or contracting to do the whole or a part of the work contemplated by this contract, shall be required or permitted to work more than eight hours in any one day or more than forty-eight hours in any one week, except in cases of extraordinary emergency. The Department or the Contractor or any sub-contractor may employ laborers, workmen and mechanics for more than eight hours in any one day in the construction or reconstruction of the highways covered by this contract when in the opinion of the Commissioner of Labor and Industries public necessity so requires. (Sec. 34, Chap. 149, G. L., Ter. Ed.)

The Contractor shall comply with the provisions of Section 179A of Chapter 149 of the General Laws, Ter. Ed., relative to giving such preference to citizens in awarding contracts for public work as is therein provided.

The Contractor shall also keep fully informed of all existing and future state and national laws and municipal ordinances and regulations in any manner affecting those engaged or employed in the work, or the materials used in the work, or in any way affecting the conduct of the work, and of all such orders and decrees of bodies or tribunals having any jurisdiction or authority over the same. The Contractor shall at all times observe and comply with, and shall cause its agents and employees to observe and comply with, all such existing and future laws, ordinances, regulations, orders and decrees; and shall protect and indemnify the Commonwealth, the Department, the Engineer and all of its and their officers and agents and servants against any claim or liability arising from or based on the violation of any such law, ordinance, regulation, order or decree, whether by said Contractor or its employees or sub-contractors.

Daily report cards, pay roll sheets, and forms for showing the cost of materials and tools bought, will be furnished by the Department of Public Works. The report cards shall be filled out daily, shall show the total cost of each day's work on each road, and shall be signed by the foreman in charge of the work. The pay roll forms shall show the cost of all labor, teams, etc., for each pay roll period, and the total cost shall conform to the amounts shown on the daily report cards for that period. The pay roll sheets shall show the amount paid to each individual; if the individual receives cash, his signature shall appear on the pay roll, showing that he has been paid, or if a check is drawn by the Town Treasurer for each individual, the number of the check entered against each amount will be equivalent. The pay roll sheet must receive "Departmental Approval" by the signature of the foreman or superintendent who makes out the pay roll for the men under his supervision, and "Accounting Approval" by the Selectman drawing the order, or by the Town Treasurer. Forms showing the cost of materials, tools, etc., bought, shall be signed by the foreman who receives the material and by the Chairman of Selectmen or the Selectman who draws the order therefor.

The wage paid to unskilled labor employed on this contract shall not exceed fifty (50) cents per hour.

On the completion of the work called for by this contract to the satisfaction of the Department of Public Works, or at intervals before the completion of the work if the selectmen so request and the Engineer recommends, the Commonwealth of Massachusetts, by said Department of Public Works, will pay or cause to be paid to said town of Southborough one-half of the

value of the work so done, based on the actual cost of the materials furnished and of the labor and teams employed in the performance of said work, as shown by the daily report cards, pay roll sheets, and forms showing the cost of materials, tools, etc., bought, properly filled out, signed and submitted to the District Highway Engineer of the Department of Public Works or his duly authorized assistant, provided, however, that the total amount to be paid by the Commonwealth to said town under this contract shall not exceed the sum of

**SIX THOUSAND SEVEN HUNDRED FIFTY DOLLARS (\$6,750.00)**

being the amount of the allotment granted to said town, for the said work, by a vote of said Department of Public Works dated July 10, 1934 : the cost in excess of the payments herein provided to be paid by said town of Southborough.

IN WITNESS WHEREOF, the parties to this agreement have hereunto set their hands this tenth day of July A. D. 1934.

THE COMMONWEALTH OF MASSACHUSETTS

By Richard H. Haig  
W. F. Callahan

Department  
of  
Public Works.

TOWN OF SOUTHBOROUGH

By George F. Freed  
Charles O. Wrenner  
George H. Bent

Board  
of  
Selectmen  
duly  
authorized.

APPROVED.

J. H. May

Commissioner of Public Works.

**MEMORANDUM OF AGREEMENT**

BETWEEN THE

**DEPARTMENT OF PUBLIC WORKS**

AND

Town of Southborough

relating to certain work to be done  
in Southborough  
under the provisions of Section 34,  
Chapter 90, of the General Laws,  
as amended.

Date, November 28, 1933

Allotment, \$ 1700.00

Approved,

Stations,

Feet.

Cost, \$

OFFICE OF

**DEPARTMENT OF PUBLIC WORKS**

STATE HOUSE

BOSTON, MASS.

THE COMMONWEALTH OF MASSACHUSETTS

DEPARTMENT OF PUBLIC WORKS

MEMORANDUM OF AGREEMENT between the Commonwealth of Massachusetts, by the Department of Public Works, and the Town of Southborough, in the County of Worcester, by its Board of Selectmen, duly authorized (hereinafter referred to as the Contractor), relating to the improvement of a section of road in said Town under the provisions of Section 34, Chapter 90 of the General Laws, as amended.

In consideration of the payments hereinafter mentioned to be made by the Commonwealth of Massachusetts, the Contractor hereby agrees to construct a reinforced concrete beam and slab bridge over the Sudbury River in the town of SOUTHBOROUGH, and to grade, surface with bituminous macadam and otherwise improve about 614 feet of road at the approach to said bridge in said town; said road leading from Southborough to Hopkinton and being known as the Cordaville Road; the work to begin at the Hopkinton line, station 0, and extend in a northerly direction to station 9+50; subject to the following conditions, viz:

**The following specifications to apply between stations 3+35.78 and 9+50.**

**First.** The road shall be graded true to the lines and grades given by the Engineer of the Department of Public Works, Division of Highways, the grading to cover a width of feet in cuts and feet on embankments. Where ledge is encountered it shall be removed to such depth as the Engineer may direct.

All clay and spongy material shall be removed to a depth to be determined by the Engineer, and the space thus made shall be filled with such material as he may direct; the upper 12 inches of the subgrade between stations 4+50 and 5 to consist of gravel spread for a width of 24 feet; the subgrade between stations 5 and 9+50 to consist of gravel spread for a width of 24 feet and to such depth as the Engineer may direct.

Before the surfacing is spread the roadbed shall be shaped to a true surface conforming to the proposed cross-section of the highway and rolled with a steam roller, unless otherwise ordered by the Engineer. All depressions occurring shall be filled with suitable material and again rolled until the surface is smooth and hard.

Outside of the graded roadway the slopes shall be extended as directed by the Engineer.

**Second.** On the roadbed prepared as hereinbefore specified, broken stone shall be spread for the width of **twenty-four feet**. All broken stone shall be laid in layers or courses.

The lower course shall consist of stones that will pass through a ring ~~2 3/4~~ inches in diameter, but will not pass through a ring **3/4 inches** in diameter. The thickness of the lower course shall be ~~2 3/4~~ inches at the centre and sides of the roadway, after rolling.

The lower course shall be shaped to a true section conforming to the proposed cross-section of the highway, and, when thoroughly rolled, shall be 2 inches below and parallel to the proposed finished surface.

Any depressions or irregularities which may occur shall be filled with broken stone of such sizes as the Engineer may direct, and again rolled until the surface is true and unyielding. The interstices in this course shall then be filled with stone screenings or sand, and, after being thoroughly rolled, the screenings or sand shall be just below the top of the broken stone, as directed by the Engineer, and no screenings or sand shall be left on top of the broken stone.

~~2 3/4~~ Upon the lower course shall be spread the upper course, consisting of stones that will pass through a ring ~~2 3/4~~ inches in diameter but will not pass through a ring  $1\frac{1}{4}$  inches in diameter. This course shall be 2 inches in thickness, after rolling. It shall be evened up with material of the same size and quality used in that particular course, and shall be rolled to the satisfaction of the Engineer.

Upon the upper course of stone, prepared as hereinbefore described, bituminous material, heated as herein-after specified, shall be uniformly applied with a pressure machine at the rate of 2 gallons to each square yard of surface, and immediately covered uniformly with clean pea stone in sufficient quantity to fill the surface voids and permit the steam roller to pass over it without sticking to the bitumen. Brooms shall be used in spreading this first coating of pea stone. The surface shall then be thoroughly rolled, and, after rolling, the surplus pea stone and dust shall be completely removed by sweeping.

A second application of bitumen shall then be made in the same manner as the first application, so as to coat the surface completely, and shall be at the rate of ~~1/2~~ half gallon per square yard. After the second application of bitumen has been made, it shall be uniformly covered with a sufficient coating of pea stone, spread as directed by the Engineer, and then thoroughly rolled.

The bituminous material used in this work shall consist of **asphalt** of a quality satisfactory to the Engineer, and when applied to the road surface it shall have a temperature approximating **300° F.**

The road shall be sprinkled with water when and as directed by the Engineer.

All depressions in any course shall be filled with the same material used in that particular course, and shall be rolled until a smooth, true and unyielding surface is obtained.

Any depressions or irregularities appearing after the final rolling shall be neatly patched in such a manner as the Engineer may direct, so that the finished surface shall be perfectly uniform and true to the specified cross-section and grade.

If at any time before the acceptance of the work any soft or imperfect places or spots shall develop in the surface, all such places shall be removed and replaced with new material, and then rolled until thoroughly compacted and until the joints or edges at which the new work connects with the old become invisible.

All broken stone shall be spread from carts by hand, or from a dumping board, or from self-spreading carts of a type approved by the Engineer.

No soft or disintegrated stone shall be used.

If so ordered by the Engineer, the thickness of the broken stone shall be increased or diminished at such places as he may direct.

The finished surface of the road shall present such a crown as the Engineer may direct.

No bituminous work shall be done during rainy weather, nor when weather conditions as to temperature or otherwise are, in the opinion of the Engineer, unsatisfactory for obtaining good results.

The work of constructing the reinforced concrete beam and slab bridge over the Sudbury River shall be done in accordance with and as specified in a contract between the towns of Southborough and Hopkinton, by their respective boards of selectmen, and the N. P. Smith Company, of Lowell, executed under date of October 3, 1933, on file in the office of the Department of Public Works; said contract being hereby made a part of this agreement. The specifications contained in said contract shall have the same force and effect as if written herein at length.

A drainage system, consisting of four catch basins, two manholes, two curb inlets and outlets aggregating 344 feet of 12-inch reinforced concrete pipe shall be constructed where and as directed by the Engineer.

A town line post shall be constructed where and as directed by the Engineer.

The wages to be paid to laborers employed in the work covered by this contract shall not exceed forty-five (45) cents an hour.

Rules, regulations and orders adopted under clause (17) of section 22 of chapter 7 of the General Laws, as appearing in the Tercentenary Edition thereof, shall, so far as may be approved by the Governor and Council, apply to the purchase of supplies and materials in the execution of this contract. (St. 1933, c. 353, s. 2)

The work covered by this contract shall be completed on or before January 6, 1934.

All of the work done and all

materials furnished under this contract shall be to the satisfaction of the Department of Public Works.

On the completion of the work hereinbefore described, all rubbish and debris shall be removed from the roadway and the roadsides, and the whole work shall be left neat and presentable.

The Contractor, in the construction of the work herein contracted for, in the employment of mechanics, teamsters and laborers, shall give preference first, to citizens of the Commonwealth who have served in the army or navy of the United States in time of war and have been honorably discharged therefrom or released from active duty therein, and who are qualified to perform the work to which the employment relates; and secondly, to citizens of the Commonwealth generally, and, if they cannot be obtained in sufficient numbers, then to citizens of the United States. ~~The wages for a day's work paid to mechanics and teamsters employed in the construction of public works as aforesaid shall be not less than the customary and prevailing rate of wages for a day's work in the same trade or occupation in the locality, city or town where such public works are constructed.~~

No laborer, workman or mechanic working within the Commonwealth in the employ of the Contractor, sub-contractor or other person doing or contracting to do the whole or a part of the work contemplated by this contract shall be required or permitted to work more than eight hours in any one day or more than forty-eight hours in any one week, except in cases of extraordinary emergency. The Department or the Contractor or any sub-contractor may employ laborers, workmen and mechanics for more than eight hours in any one day in the construction or reconstruction of the highways covered by this contract when in the opinion of the Commissioner of Labor and Industries public necessity so requires. Every employee in the work covered by this contract shall lodge, board and trade where and with whom he elects, and neither the Contractor nor his agents or employees shall directly or indirectly require as a condition of employment therein that an employee shall lodge, board or trade at a particular place or with a particular person.

The Contractor shall comply with the provisions of Chapter 149 of the General Laws as amended by Chapter 517 of the Acts of 1922 relative to giving such preference to citizens in awarding contracts for public work as is therein provided.

The Contractor shall also keep fully informed of all existing and future state and national laws and municipal ordinances and regulations in any manner affecting those engaged or employed in the work, or the materials used in the work, or in any way affecting the conduct of the work, and of all such orders and decrees of bodies or tribunals having any jurisdiction or authority over the same. The Contractor shall at all times observe and comply with, and shall cause its agents and employees to observe and comply with, all such existing and future laws, ordinances, regulations, orders and decrees; and shall protect and indemnify the Commonwealth, the Department, the Engineer and all of its and their officers and agents and servants against any claim or liability arising from or based on the violation of any such law, ordinance, regulation, order or decree, whether by said Contractor or its employees or sub-contractors.

No materials shall be purchased for said work without first obtaining the written approval of the Engineer as to quality, quantity and price. The cost of tools and/or machinery shall not be charged to the work covered by this contract.

All accounts relating to said work shall be kept up to date by the town/city officials at all times and shall be available to the Engineer for checking at intervals during the progress of the work.

Before final payment is made to the town/city as hereinafter provided, the officials executing this contract on behalf of the town/city shall file with the Engineer a detailed statement showing all of the expenditures made for or on account of the work covered by said contract and shall certify as to the accuracy of said statement.

On the completion of the work called for by this contract to the satisfaction of the Department of Public Works, or at intervals before the completion of the work if the Contractor so requests and the Engineer recommends, the Commonwealth of Massachusetts, by said Department of Public Works, will pay or cause to be paid to said Town/City

of SOUTHBOROUGH one-third of

in the town of Southborough the value of the work so done, based on the actual cost of the materials furnished and on the actual prices paid for labor and teams employed in the performance of said work, as shown by the Contractor's paid vouchers and itemized bills, and by estimates approved by the District Highway Engineer of the Department of Public Works, or his duly authorized assistant, the prices to be paid for labor and teams being the current prices in the locality; provided, however, that the total amount to be paid by the Commonwealth to said Town/City under this contract shall not exceed the sum of

SEVENTEEN HUNDRED DOLLARS.....(\$1700.00)

being the amount of the allotment made for said work by a vote of said Department of Public Works dated May 16, 1933; the cost in excess of the payments herein provided to be borne by said Town/City of Southborough.

The undersigned Town/City officials agree that the section of road covered by this contract will be kept by the Town/City at all times in good repair and condition as provided by Section 25, Chapter 81 of the General Laws, as amended by Chapter 428 of the Acts of the year 1921.

In Witness Whereof, the parties to this agreement have hereunto set their hands this twenty-eighth day of November A. D., 1933.

THE COMMONWEALTH OF MASSACHUSETTS

BY

Richard K. Key  
Alfred M. Reed

Department

of

Public Works

TOWN/CITY OF SOUTHBOROUGH

BY

George F. Fecan  
George Smith  
Charles O. Merven

Board of  
Selectmen,

duly  
authorized,

Approved:

W. H. Morris  
Commissioner of Public Works

No. 4455

MEMORANDUM OF AGREEMENT

BETWEEN THE

DEPARTMENT OF PUBLIC WORKS

AND

TOWN OF SOUTHBOROUGH

relating to certain work to be done  
in SOUTHBOROUGH  
under the provisions of Section 34,  
Chapter 90, of the General Laws.

Date, August 21, 1934.

Allotment, \$ 3,100.00

Approved,

Stations,

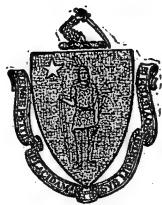
Feet.

Cost, \$

OFFICE OF

DEPARTMENT OF PUBLIC WORKS

100 NASHUA STREET BOSTON, MASS.



## The Commonwealth of Massachusetts

## DEPARTMENT OF PUBLIC WORKS

**Memorandum of Agreement** between the Commonwealth of Massachusetts, by the Department of Public Works, and the Town/City of **SOUTHBOROUGH**, in the County of **WORCESTER**, by its **Board of Selectmen**, duly authorized (hereinafter referred to as the Contractor), relating to the improvement of a section of road in said town/city under the provisions of Section 34, Chapter 90 of the General Laws, Ter. Ed.

In consideration of the payments hereinafter mentioned to be made by the Commonwealth of Massachusetts, the Contractor hereby agrees to **grade, surface with gravel and tar mixed in place and otherwise improve about 2200 feet of road in Southborough, leading from Marlborough, and being known as Jericho Hill Road;**

the work to begin **at the Marlborough line, station 0, and extend southerly to station 22;**

subject to the following conditions, viz.:—

First. The road shall be graded to a width of 23 feet in cuts and 23 feet on embankments; the upper 16 inches of gravel between stations 0 and 3; the upper 3 inches of gravel between stations 3 and 22; and the upper 4 inches of gravel between stations 3 and 22 shall be spread for a width of 30 feet. Outside the graded roadway the slopes shall be extended as directed by the Engineer.

Second. Upon the graded roadway, a surface shall be constructed of gravel and tar mixed in place in accordance with the requirements of Addendum I attached hereto.

Third. A drainage system, consisting of a drop inlet, ditch inlet and outlets aggregating 89 feet of 12-inch coated corrugated metal pipe and 50 feet of 30-inch coated corrugated metal pipe, shall be constructed where and as directed by the Engineer.

Fourth. The aforesaid work shall be done as directed by the Engineer and in accordance with the standard specifications of the Department of Public Works applicable thereto.

Fifth. The work covered by this contract shall be completed on or before September 15, 1934.

Sixth. The wage paid to unskilled labor employed on this contract shall not exceed fifty (50) cents per hour.

ADDENDUM I

Mixed In Place Surfacing  
(Re-tread)

June 25, 1934

Section I-1. Description.

This type of surfacing shall consist of approved gravel (or stone) spread and mixed with bituminous material upon a gravel (or stone) base course as directed and in accordance with these specifications. The seal coat shall consist of a final superficial application of bituminous material covered with sand.

Note: Section references in the following specification are to the 1934<sup>3</sup> edition of the Department's Standard Specifications for Highways and Bridges.

Section I-2. Materials.

BITUMINOUS MATERIAL shall consist of tar and shall conform to the following requirements: (Dept. Spec. No. 14A.)

	Min.	Max.
1. Water, percent by volume .....		2.0
2. Specific gravity 25°/25°C (77°/77°F) ....	1.10	
3. Specific viscosity, Engler 50 cc at 50°C (122°F) .....	16	36
4. Total bitumen (soluble in carbon disulphide) .....	88	
5. Total distillation by weight: (Water free)		
To 170°C (338°F) .....		5
To 270°C (518°F) .....		25
To 300°C (572°F) .....		35
(a) Softening point of residue from distillation test, °C (R & B) ....	38.0	70

Note: The following limits of specific viscosity shall be used:

For gravel aggregate .....	16	-	26
For broken stone aggregate .....	26	-	36

GRAVEL shall conform to the requirements of Section 16 except that it shall be of such size that it will pass a screen having a circular opening of one and one half (1-1/2) inches.

BROKEN STONE shall be No. 2 stone and pea stone, conforming to Section 32.

SAND shall be clean and free from all loam, clay and other adventitious matter, and shall be satisfactory to the Engineer.

Section I-3. Construction Methods.

A. GRAVEL AGGREGATE. A gravel base course of the depth shown on the plans or as directed shall be constructed on the sub-base or foundation according to the requirements of Section 21.

Gravel for the surfacing shall be spread upon the base course prepared as above specified, by means of mechanical spreaders or by adjusting the tailgate and spreading directly from the trucks. After the gravel has been spread it shall be brought to a uniform width and depth by means of a road grader. The depth of the gravel shall be two (2) inches. Tar shall then be applied at the rate of four tenths (0.4) of a gallon per square yard of road surface and distributed by means of an approved pressure machine. This machine

shall be so designed as to enable its operator to control the flow and to distribute the material uniformly under a pressure of not less than thirty (30) pounds per square inch leaving no streaks or spots and so designed as to enable its operator to "cut out" any portion of the roadway and to avoid any surplus deposit of the material on the roadway or elsewhere.

After the tar has been applied, the gravel and the tar shall then be thoroughly mixed by means of a road machine as follows:

Starting at the outer edges of the roadway, all loose gravel and tar previously spread upon the base course shall be bladed to a windrow in the center. When this has been done, the windrow shall be respread to a uniform thickness upon the base course and this process shall be repeated until the tar and the gravel have been thoroughly and uniformly mixed. The mixture shall then be smoothly graded to the desired cross section.

After the mixture has been so graded, it shall be rolled by a ten (10) ton roller, as soon as its consistency is such that it will not adhere to the wheels of the roller. The surfaces of the wheels of the roller must be kept clean at all times and either oiled or wetted with water as ordered by the Engineer. When the use of water is permitted, it shall be applied in such quantity that surplus water will not run off the wheels of the roller onto the pavement. The rolling shall be done as directed by the Engineer.

If in the opinion of the Engineer, during the course of the blading above described, more gravel or more tar is required these materials shall be added as directed, and this second application of tar shall be at the rate of approximately three tenths (0.3) of a gallon per square yard of surface. The blading process shall then be continued until a complete and uniform mixture has been obtained.

After the surface has been rolled as above specified a seal coat of tar meeting the same specifications as that used in mixing shall be applied at the rate of approximately one quarter (1/4) of a gallon per square yard of road surface. This application of tar so applied shall be uniformly covered with a sufficient layer of sand and dragged. The drag used shall be either a brush or a blade drag, and the dragging shall continue until the tar and sand are thoroughly mixed and uniformly distributed.

No bituminous work shall be done during rainy weather nor when weather conditions as to temperature or otherwise are in the opinion of the Engineer unfavorable for obtaining satisfactory results.

All unsatisfactory material shall be removed and replaced by the Contractor at his own expense.

Tar delivered in tank truck distributors or tank truck feeders from refineries or distributing plants shall be weighed on scales furnished by and at the expense of the Contractor. Said scales shall be sealed at the expense of the Contractor as often as necessary to insure their accuracy. At the option of the Party of the First Part, a sworn weigher to be appointed and compensated by the Party of the First Part shall weigh all tar required to be weighed.

B. BROKEN STONE AGGREGATE. The base course shall consist of broken stone as specified in Sections 31 to 34 inclusive and shall have a maximum thickness of two (2) inches.

Addendum I - 3

Broken stone shall be spread upon the base course and brought to a uniform depth as specified. The tar shall be applied in three applications as specified above except that the rates of application shall be as directed by the Engineer. A sufficient quantity of pea stone shall be added to the No. 2 stone as directed to fill the voids and firmly lock the stones together. All grading and mixing operations shall be as specified above in Section I-3A.

Suitable guard rail shall be built wherever such a safeguard is necessary to protect travelers on the highway.

All of the work done and all of the materials furnished under this contract shall be to the satisfaction of the Department of Public Works.

On the completion of the work hereinbefore described, all rubbish and debris shall be removed from the roadway and the roadsides, and the whole work shall be left neat and presentable.

No materials shall be purchased for said work without first obtaining the written approval of the Engineer as to quality, quantity and price. The cost of tools and/or machinery shall not be charged to the work covered by this contract.

All accounts relating to said work shall be kept up to date by the town/city officials at all times and shall be available to the Engineer for checking at intervals during the progress of the work.

Before final payment is made to the town/city as hereinafter provided, the officials executing this contract on behalf of the town/city shall file with the Engineer a detailed statement showing all of the expenditures made for or on account of the work covered by said contract and shall certify as to the accuracy of said statement.

Rules, regulations and orders adopted under clause (17) of section 22 of chapter 7 of the General Laws, as appearing in the Tercentenary Edition thereof, shall, so far as may be approved by the Governor and Council, apply to the purchase of supplies and materials in the execution of this contract. (St. 1933, ch. 353, sec. 2). These rules require a preference in the purchase of supplies and materials, other considerations being equal, in favor, first, of supplies and materials manufactured and sold within the Commonwealth, and second, of supplies and materials manufactured and sold within the United States.

Every employee in the work covered by this contract shall lodge, board and trade where and with whom he elects, and neither the Contractor nor his agents or employees shall directly or indirectly require as a condition of employment therein that an employee shall lodge, board or trade at a particular place or with a particular person. (Sec. 25, Chap. 149, G. L., Ter. Ed.)

The Contractor, in the work herein contracted for, in the employment of mechanics, teamsters, and laborers, shall give preference first, to citizens of the Commonwealth who have served in the army or navy of the United States in time of war and have been honorably discharged therefrom or released from active duty therein, and who are qualified to perform the work to which the employment relates; and secondly, to citizens of the Commonwealth generally, and, if they cannot be obtained in sufficient numbers, then to citizens of the United States. (Sec. 26, Chap. 149, G. L., Ter. Ed.)

No laborer, workman or mechanic working within the Commonwealth, in the employ of the Contractor, sub-contractor or other person doing or contracting to do the whole or a part of the work contemplated by this contract, shall be required or permitted to work more than eight hours in any one day or more than forty-eight hours in any one week, except in cases of extraordinary emergency. The Department or the Contractor or any sub-contractor may employ laborers, workmen and mechanics for more than eight hours in any one day in the construction or reconstruction of the highways covered by this contract when in the opinion of the Commissioner of Labor and Industries public necessity so requires. (Sec. 34, Chap. 149, G. L., Ter. Ed.)

The Contractor shall comply with the provisions of Section 179A of Chapter 149 of the General Laws, Ter. Ed., relative to giving such preference to citizens in awarding contracts for public work as is therein provided.

The Contractor shall also keep fully informed of all existing and future state and national laws and municipal ordinances and regulations in any manner affecting those engaged or employed in the work, or the materials used in the work, or in any way affecting the conduct of the work, and of all such orders and decrees of bodies or tribunals having any jurisdiction or authority over the same. The Contractor shall at all times observe and comply with, and shall cause its agents and employees to observe and comply with, all such existing and future laws, ordinances, regulations, orders and decrees; and shall protect and indemnify the Commonwealth, the Department, the Engineer and all of its and their officers and agents and servants against any claim or liability arising from or based on the violation of any such law, ordinance, regulation, order or decree, whether by said Contractor or its employees or sub-contractors.

On the completion of the work called for by this contract to the satisfaction of the Department of Public Works, or at intervals before the completion of the work if the Contractor so requests and the Engineer recommends, the Commonwealth of Massachusetts, by said Department of Public Works, will pay or cause to be paid to said Town/City of **SOUTHBOROUGH one-half of**

the value of the work so done, based on the actual cost of the materials furnished and on the actual prices paid for labor and teams employed in the performance of said work, as shown by the Contractor's paid vouchers and itemized bills, and by estimates approved by the District Highway Engineer of the Department of Public Works, or his duly authorized assistant; provided, however, that the total amount to be paid by the Commonwealth to said Town/City under this contract shall not exceed the sum of

**TWENTY-ONE HUNDRED DOLLARS (\$2100.00)**

being the amount of the allotment made for said work by a vote of said Department of Public Works dated **April 24 and June 26, 1934**; the cost in excess of the payments herein provided to be borne by said Town/City of **Southborough**.

The undersigned Town/City officials agree that the section of road covered by this contract will be kept by the Town/City at all times in good repair and condition as provided by Section 25, Chapter 81 of the General Laws, Ter. Ed.

IN WITNESS WHEREOF, the parties to this agreement have hereunto set their hands this  
day of **August**, A. D., **1934.**

**twenty-first**

THE COMMONWEALTH OF MASSACHUSETTS

By.....

*Richard K. Hayes*

*W. F. Callahan*

*Department  
of  
Public Works.*

Town/City of **SOUTHBOROUGH**

By.....

*George F. Field*

*George H. Smith*

*Board of  
Selectmen,*

*duly  
authorized.*

APPROVED:

*Arthur W. Brown*

*Acting Commissioner of Public Works.*

No. 5139

**MEMORANDUM OF AGREEMENT**

BETWEEN THE

**Department of Public Works**

AND

**TOWN OF SOUTHBOROUGH**

relating to certain work to be done  
in ..... SOUTHBOROUGH .....  
under the provisions of Section 34,  
Chapter 90, of the General Laws,  
Ter. Ed.

Date, October 22, 1935.

Allotment, \$ 510.00

Approved, .....

Stations, .....

Feet.

Cost, \$ .....

OFFICE OF

**DEPARTMENT OF PUBLIC WORKS**

100 NASHUA STREET BOSTON, MASS.



## The Commonwealth of Massachusetts

### DEPARTMENT OF PUBLIC WORKS

Memorandum of Agreement between the Commonwealth of Massachusetts, by the Department of Public Works, and the Town/City of **SOUTHBOROUGH**, in the County of **WORCESTER**, by its **Board of Selectmen**,

duly authorized (hereinafter referred to as the Contractor), relating to the improvement of a section of road in said town/city under the provisions of Section 34, Chapter 90 of the General Laws, Ter. Ed.

In consideration of the payments hereinafter mentioned to be made by the Commonwealth of Massachusetts, the Contractor hereby agrees to **repair, treat with bituminous material and otherwise improve about 22,000 feet of roads in Southborough, leading to adjoining towns, and being known as Framingham and Concord Roads;**

the work to ~~be done in two sections:~~

**Section 1 - beginning at the Marlborough line, station 0, and extending southeasterly to station 135+50;**

**Section 2 - beginning at the Hopkinton line, station 0, and extending northerly to station 84+50;**

subject to the following conditions, viz.:—

At such places as the Engineer may direct the present road surface shall be loosened with picks placed in the wheels of a steam roller, or otherwise. The material loosened shall be scarified or harrowed, and the surface shall be reshaped, watered and rolled, and such new gravel added as the Engineer may direct.

On the sections which do not require such loosening, scarifying, etc., the surface shall be patched with a mixture of patching compound and broken stone or screened gravel, the stones to be such sizes as the Engineer may direct; and the entire surface to be treated shall be scraped with a road scraper or dragged with road drags, as directed by the Engineer.

After the surface has been prepared to the satisfaction of the Engineer, a binder consisting of tar, asphaltic oil, cut-back, emulsion of other bituminous material of a quality satisfactory to the Engineer shall be applied in such quantity as he may direct. The bitumen shall be applied in a thin film, and distributed evenly by means of a pressure machine approved by the Engineer. The machine shall be so designed as to enable the operator to control the flow and to distribute the material uniformly, leaving no streaks or spots, and so designed as to enable the operator to "cut out" any portion of the roadway and to avoid any surplus deposit of the binder on the roadway. If the Engineer shall so direct the bituminous binder shall also be further distributed by means of soft brooms or "squeegees."

If so directed by the Engineer, the bituminous binder shall be applied on one-half of the roadway at a time, so that the road may be kept open to travel; and immediately after the bituminous binder is applied, as above specified, a thin layer of sand shall be distributed evenly thereon in sufficient quantity to absorb all surplus oil, prevent it from being tracked off by vehicles, and form a true surface.

The sand used shall be clean, sharp and dry, free from loam, clay and adventitious matter of all kinds. It shall contain no pebbles which will not pass through a half-inch mesh, nor practically any grains or particles which will pass through a screen of 30 meshes to the lineal inch.

No bituminous work shall be done during rainy weather nor when weather conditions as to temperature or otherwise are, in the opinion of the Engineer, unfavorable for obtaining satisfactory results.

The surface of the roadway when completed shall present such a crown as the Engineer may direct.

Suitable signs shall be erected to warn the public to keep off the section under treatment during the application of the bituminous binder and until suitably covered.

The road surface shall be maintained throughout the season as directed by the Engineer.

The work covered by this contract shall be completed on or before November 30, 1935.

~~The wage paid for unskilled labor employed on this contract shall not exceed fifty (50) cents per hour, and the prices paid for hired trucks and drivers per hour shall be the following amounts:~~

<u>Size of Body</u>	<u>Carrying Capacity</u>	<u>Total Reg. Cap.</u>	
		<u>Truck and Load</u>	<u>Amount</u>
1 to 2 Yard Body	Up to 6,000 lbs.	Net over 11,500 lbs.	\$1.50
2½ to 3 Yard Body	7,500 to 8,000 lbs.	Net over 18,000 lbs.	2.00
3½ to 4 Yard Body	10,000 to 12,000 lbs.	Net over 24,000 lbs.	2.50
4 to 5 Yard Body	14,000 to 16,000 lbs.	Net over 30,000 lbs.	3.00

A reinforced concrete headwall shall be constructed where and as directed by the Engineer.

The aforesaid work shall be done as directed by the Engineer and in accordance with the standard specifications of the Department of Public Works applicable thereto.

Suitable guard rail shall be built wherever such a safeguard is necessary to protect travelers on the highway.

All of the work done and all of the materials furnished under this contract shall be to the satisfaction of the Department of Public Works.

On the completion of the work hereinbefore described, all rubbish and debris shall be removed from the roadway and the roadsides, and the whole work shall be left neat and presentable.

No materials shall be purchased for said work without first obtaining the written approval of the Engineer as to quality, quantity and price. The cost of tools and/or machinery shall not be charged to the work covered by this contract.

All accounts relating to said work shall be kept up to date by the town/city officials at all times and shall be available to the Engineer for checking at intervals during the progress of the work.

Before final payment is made to the town/city as hereinafter provided, the officials executing this contract on behalf of the town/city shall file with the Engineer a detailed statement showing all of the expenditures made for or on account of the work covered by said contract and shall certify as to the accuracy of said statement.

Rules, regulations and orders adopted under clause (17) of section 22 of chapter 7 of the General Laws, as appearing in the Tercentenary Edition thereof, shall, so far as may be approved by the Governor and Council, apply to the purchase of supplies and materials in the execution of this contract. (St. 1933, ch. 353, sec. 2). These rules require a preference in the purchase of supplies and materials, other considerations being equal, in favor, first, of supplies and materials manufactured and sold within the Commonwealth, and second, of supplies and materials manufactured and sold within the United States.

Every employee in the work covered by this contract shall lodge, board and trade where and with whom he elects, and neither the Contractor nor his agents or employees shall directly or indirectly require as a condition of employment therein that an employee shall lodge, board or trade at a particular place or with a particular person. (Sec. 25, Chap. 149, G. L., Ter. Ed.)

The Contractor, in the work herein contracted for, in the employment of mechanics, teamsters, and laborers, shall give preference first, to citizens of the Commonwealth who have served in the army or navy of the United States in time of war and have been honorably discharged therefrom or released from active duty therein, and who are qualified to perform the work to which the employment relates; and secondly, to citizens of the Commonwealth generally, and, if they cannot be obtained in sufficient numbers, then to citizens of the United States. (Sec. 26, Chap. 149, G. L., Ter. Ed.)

No laborer, workman or mechanic working within the Commonwealth, in the employ of the Contractor, sub-contractor or other person doing or contracting to do the whole or a part of the work contemplated by this contract, shall be required or permitted to work more than eight hours in any one day or more than forty-eight hours in any one week, except in cases of extraordinary emergency. The Department or the Contractor or any sub-contractor may employ laborers, workmen and mechanics for more than eight hours in any one day in the construction or reconstruction of the highways covered by this contract when in the opinion of the Commissioner of Labor and Industries public necessity so requires. (Sec. 34, Chap. 149, G. L., Ter. Ed.)

The Contractor shall comply with the provisions of Section 179A of Chapter 149 of the General Laws, Ter. Ed., relative to giving such preference to citizens in awarding contracts for public work as is therein provided.

The Contractor shall also keep fully informed of all existing and future state and national laws and municipal ordinances and regulations in any manner affecting those engaged or employed in the work, or the materials used in the work, or in any way affecting the conduct of the work, and of all such orders and decrees of bodies or tribunals having any jurisdiction or authority over the same. The Contractor shall at all times observe and comply with, and shall cause its agents and employees to observe and comply with, all such existing and future laws, ordinances, regulations, orders and decrees; and shall protect and indemnify the Commonwealth, the Department, the Engineer and all of its and their officers and agents and servants against any claim or liability arising from or based on the violation of any such law, ordinance, regulation, order or decree, whether by said Contractor or its employees or sub-contractors.

On the completion of the work called for by this contract to the satisfaction of the Department of Public Works, or at intervals before the completion of the work if the Contractor so requests and the Engineer recommends, the Commonwealth of Massachusetts, by said Department of Public Works, will pay or cause to be paid to said Town/City of **SOUTHBOROUGH one-third of** the value of the work so done, based on the actual cost of the materials furnished and on the actual prices paid for labor and teams employed in the performance of said work, as shown by the Contractor's paid vouchers and itemized bills, and by estimates approved by the District Highway Engineer of the Department of Public Works, or his duly authorized assistant; provided, however, that the total amount to be paid by the Commonwealth to said Town/City under this contract shall not exceed the sum of

**FIVE HUNDRED AND TEN DOLLARS (\$510.00)**

being the amount of the allotment made for said work by a vote of said Department of Public Works dated **May 28, 1935**; the cost in excess of the payments herein provided to be borne by said Town/City of **Southborough**.

The undersigned Town/City officials agree that the section of road covered by this contract will be kept by the Town/City at all times in good repair and condition as provided by Section 25, Chapter 81 of the General Laws, Ter. Ed.

IN WITNESS WHEREOF, the parties to this agreement have hereunto set their hands this **twenty-second** day of **October**, A. D., **1935.**

THE COMMONWEALTH OF MASSACHUSETTS

By *George H. Delano*  
*Acting Commissioner of Public Works*  
*Robert L. Parker*  
*John H. Moore*

Department  
of  
Public Works.

Town/City of **SOUTHBOROUGH**  
By *George F. Freed*  
*Robert L. Parker*  
*George H. Smith*

Board of  
Selectmen  
only  
authorized.

APPROVED: *George H. Delano*  
acting Commissioner of Public Works.

Marlboro Road Contract  
July 1926

CONTRACT No. \_\_\_\_\_

CONTRACT DATE, \_\_\_\_\_

CONTRACTOR, \_\_\_\_\_

The Commonwealth of Massachusetts

TOWN—CITY OF \_\_\_\_\_ Southborough \_\_\_\_\_

CONTRACT WITH SPECIFICA

FOR

CONSTRUCTING A SECTION OF HIGHWAY IN THE

TOWN — CITY OF \_\_\_\_\_ Southborough \_\_\_\_\_

COUNTY OF \_\_\_\_\_ Worcester \_\_\_\_\_

The Commonwealth of Massachusetts

Town of Southborough

NOTICE TO CONTRACTORS.

Sealed proposals, addressed to the Board of Selectmen of ..... Southborough ..... and endorsed "Proposals for constructing — resurfacing — reconstructing a section of highway in the Town of .. Southborough .. ....," will be received by the Board of Selectmen at the office of the Department of Public Works, Division of Highways, Room 413, State House, Boston, Mass., until 1 o'clock P.M., of ... Tuesday July 27 ... 1926, and at that place and time will be publicly opened and read.

Plans may be seen and forms of specification and contract may be obtained at the office of the Department of Public Works, Division of Highways, State House, Boston, Mass.

The right is reserved to reject any and all proposals, or to accept the proposal deemed best for the Town — ~~City~~ of Southborough.

DATE ..... July 17 ..... 1926

..... Francis D. Newton .....  
..... Chas. F. Choate ..... 34  
..... George F. Field .....  
.....  
.....

BOARD OF  
SELECTMEN  
OF THE  
TOWN OF  
Southborough

## SPECIFICATIONS

### **Article I. Definition of Terms.**

The words "party of the first part," or a pronoun in place of them, shall mean the Board of Selectmen of .....

..... **Southborough** .....; and no member of said Board shall be personally responsible for any liability arising under this contract.

The word "Engineer," or a pronoun in place of it, shall mean the person holding the position or acting in the capacity of Engineer of the party of the first part, acting either directly or through properly authorized agents, such agents acting within the scope of the particular duties entrusted to them.

The word "Contractor," or a pronoun in place of it, shall mean the party or parties contracting to perform the work covered by this contract or his or their legal representatives.

The word "Town" where used in these Specifications shall mean the municipality represented in this contract.

The words *approval of the party of the first part* or *approved by the party of the first part* shall mean an approval in writing signed by a majority of the members of the Board for the time being.

Whenever any power is possessed by, or act or thing is to be done by, the Town under this contract, the exercise of such power or the doing of such act or thing by the party of the first part shall be a sufficient compliance with the terms of this contract, unless by law some other officer of the Town is required to act in the premises.

### INSTRUCTIONS TO BIDDERS.

### **Article II. Interpretation of Basic Estimate.**

All bids will be compared on the estimate of quantities of work to be done, as shown on the proposal.

These quantities are approximate only, being given as a basis for the comparison of bids, and the party of the first part does not expressly or by implication agree that the actual amount of work will correspond therewith, but reserves the right to increase or decrease the amount of any class or portion of the work, as may be deemed necessary or expedient by the party of the first part.

Bidders are required to submit their estimates upon the following express conditions, which shall apply to, and become part of every bid received, viz.:

An increase or decrease in the quantity for any item shall not be regarded as a sufficient ground for an increase or decrease in the prices, nor in the time allowed for the completion of the work, except as provided in the contract.

The excavation, masonry and other parts of the work have been divided into classes and items in order to enable the bidder to bid for the different portions of the work in accordance with his estimate of their cost, so that in the event of an increase or decrease in the quantities of any particular class of work, the actual quantities executed may be paid for at the price bid for that particular class of work.

### **Article III. Examination of Plans, Location, etc.**

The bidder shall carefully examine the location of the proposed work, the character of the work required, the quality and source of supply of materials, the annexed proposed form of contract, specifications and the plans therein referred to, and shall propose and agree if his proposal is accepted, that he will contract with the party of the first part, in the form of the copy of the contract annexed hereto, to provide all necessary machinery, tools, apparatus and other means of construction, and to do all the work and furnish all the materials specified in the contract, in the manner and time therein prescribed, and according to the requirements of the Engineer as therein set forth, and that he will take in full payment therefor the unit prices — as are set out in the accompanying proposal.

### **Article IV. Familiarity with Laws.**

The attention of the bidder is called to the necessity of keeping himself fully informed of all existing and future state and national laws and municipal ordinances as required by Article XXIV.

### **Article V. Instructions for Filling in Proposal Form.**

The bidder shall submit his proposal upon the blank form as herein contained. The bidder shall specify a unit price, in both words and figures, for each of the separate items so called for. All writing and figures shall be in ink.

In case of a discrepancy between the prices written in words and those written in figures, the written words shall govern.

### **Article VI. Signatures on Proposals.**

The bidder shall sign his proposal correctly. If the proposal is made by an individual, his name and post office address must be given. If made by a firm or partnership, the name and post office address of the firm or partnership and of each member thereof must be given. If made by a corporation, the person signing the proposal must give the name of the State under the laws of which the corporation was chartered and the names, titles and business addresses of the President, Treasurer and Manager.

### **Article VII. Irregular Proposals.**

Proposals which are incomplete, conditional or obscure, or which contain additions not called for, erasures, alterations or irregularities of any kind, may be accepted or may be rejected as informal.

### **Article VIII. Proposal Guaranty.**

Each proposal must be accompanied by a certified check for \$ 7.00 ....., payable to the order of the Town of ... **Southborough** ....., the amount of such check to be returned to the bidder unless retained by the Town under the conditions hereinafter stipulated.

The check must *not* be enclosed in the sealed envelope with the proposal, but must be delivered to the Financial Secretary of the Division of Highways, who will give a proper voucher for the deposit.

### **Article IX. Beginning, Progress and Completion of Work.**

It is the purpose of the party of the first part to complete the work in the shortest time consistent with good construction. To this end, contractors will be required to use improved methods and appliances for doing the various parts of the work. Complete and well-designed equipment and effective organization will be insisted upon.

*The attention of bidders is especially directed to the requirements as to the time of beginning work, its progress and the date for completion of the whole work, as required by Article XVII.*

**Article X. Qualification of Bidders.**

Before the award of the contract, any bidder may be required to show that he has the necessary facilities, experience, ability and financial resources to perform the work in a satisfactory manner and within the time stipulated, and that he has had experience in constructing works of the same or a similar nature.

**AWARD AND EXECUTION OF CONTRACT.****Article XI. Contract Bond Required.**

A bond will be required for the faithful performance of the contract in such sum as shall be fixed by the party of the first part after the bids are opened. The surety may be a surety company satisfactory to said party of the first part, or securities satisfactory to said party of the first part.

**Article XII. Execution of Contract.**

The Contractor to whom the contract may be awarded will be required to appear at this office, with the surety offered by him, and execute the contract within six days (not including Sunday) from the date of the mailing of a notice from the party of the first part to the bidder, according to the address given by him, that the contract is ready for signature, and, in case of his failure or neglect so to do, the party of the first part may at its option determine that the bidder has abandoned the contract and thereupon the proposal and acceptance shall be null and void, and the check accompanying the proposal shall be retained and collected by the Town as liquidated damages for the delay and expense caused by the abandonment of the contract.

The contract shall be in writing and executed in triplicate, one of which triplicates shall be kept by the party of the first part, one delivered to the Department of Public Works, Division of Highways, of the Commonwealth of Massachusetts, and one to said Contractor.

**Article XIII. Assignment or Subletting.**

The Contractor shall give his personal attention constantly to the faithful prosecution of the work, shall keep the same under his personal control, and shall not assign by power of attorney or otherwise, or sublet, the work or any part thereof without the previous written consent of the party of the first part, and shall not, either legally or equitably, assign any of the moneys payable under this agreement, or his claim thereto, unless by and with the like consent of the party of the first part.

**GENERAL PROVISIONS.****Article XIV. Scope of Work.**

The work to be done consists of the following, viz.: to furnish all labor, implements, tools, machinery and materials, except as herein otherwise specified, required to construct and put in complete order for use the said road, including culverts, fences and other appertaining structures, and to leave the grounds in a neat condition.

The Contractor shall do all the work and furnish all the materials, tools and appliances, except as herein otherwise specified, necessary or proper for performing and completing the work required by this contract, in the manner and *within the time* hereinafter specified. He shall complete the entire work to the satisfaction of the Engineer, and in accordance with the specifications and drawings for the work, at the prices herein agreed upon and fixed therefor. All the work, labor and materials to be done and furnished under this contract shall be done and furnished strictly pursuant to, and in conformity with the attached specifications and the drawings for the work, which said specifications and drawings form parts of this contract, and also in accordance with the directions of the Engineer as given from time to time during the progress of the work, under the terms of this contract. The notice to Contractors hereto attached and the proposal submitted by the Contractor are also made parts of this contract.

**Article XV. Alteration of Work.**

Should it be found desirable by the Engineer to make alterations in the form or character of any of the work done, or to be done, the Engineer may order such alterations to be made, defining them in writing, supplemented with drawings when in the opinion of the Engineer it is necessary, and they shall be made accordingly; provided that in case such change increases the cost of the work the Contractor shall be remunerated at prices based on prices allowed on the same character of work under these specifications, and in case they shall diminish the cost of the work, no allowance will be made for anticipated profits.

In case of any alterations, so much of this contract as is not necessarily affected by such alterations shall remain in force upon the parties hereto, and such alterations shall be made under the terms of and as a part of this contract, and the security for the performance of this contract shall in nowise be invalidated, but shall be held to secure in like manner the performance of the alterations made under the contract and of any extra work done under the provisions of Article XVI.

**Article XVI. Extra Work.**

The Contractor shall do any work not herein otherwise provided for, when and as ordered in writing by the Engineer, such written order to contain particular reference to this article, and shall, when requested by the Engineer so to do, furnish itemized statements of the cost of the work ordered and give the Engineer access to accounts, bills and vouchers relating thereto. If the Contractor claims compensation for extra work not ordered as aforesaid, or for any damage sustained, he shall, within one week after the beginning of any such work or of the sustaining of any such damage, make a written statement of the nature of the work performed or damage sustained, to the Engineer, and shall, on or before the fifteenth day of the month succeeding that in which any such extra work shall have been done or any such damage shall have been sustained, file with the Engineer an itemized statement of the details and amount of such work or damage; and unless such statements shall be made as so required, his claim for compensation shall be forfeited and invalid, and he shall not be entitled to payment on account of any such work or damage. The determination of the Engineer shall be final upon all questions of the amount and value of extra work. Unless the price to be paid for extra work ordered as aforesaid is set in the order therefor, the Contractor shall accept as full payment therefor the actual cost of all materials furnished by him as determined by the Engineer, and for such labor, teams and motor trucks as are necessary in the performance thereof he shall accept the current prices in the locality, which shall have been previously agreed to in writing by the Contractor and the Engineer, plus 15 per cent of such cost of labor, teams and motor trucks, plus the actual cost of the workingmen's compensation insurance, public liability insurance and contractor's bond incurred on account of said extra work.

### **Article XVII. Beginning, Prosecution, Progress and Completion of Work.**

The Contractor shall begin work within 15 days after the award of the contract, or within such other period as the Engineer shall authorize in writing, approved by the party of the first part, at such points as the Engineer may direct, and shall thereafter prosecute the work at such points and in such order as the Engineer may from time to time prescribe.

If at any time during the progress of the work satisfactory progress shall not have been made, the Contractor shall increase the force, machinery and equipment as directed by the Engineer, but the failure of the Engineer to make such demand shall not relieve the Contractor of his obligation to complete the work at the time specified in this contract.

On or before *October 2* 1926, the whole work shall have been performed in accordance with the terms of this contract.

The time in which the various portions and the whole of this contract are to be performed and the work is to be completed is of the essence of this contract.

If any part of the work shall be delayed under the provisions of Article XV, XVI or XVIII, the Contractor will be allowed additional time, as provided in said Article XVIII.

### **Article XVIII. Delay in Commencing Work.**

The party of the first part may delay the commencement of the work, or any part thereof, if the party of the first part shall deem it for the interest of the Town so to do. The Contractor shall have no claim for damages on account of such delay, but shall be entitled to so much additional time in which to complete the whole or any portion of the work required under this contract as the Engineer shall certify in writing to be just. The Contractor shall have no claim for damages on account of any delay on the part of the party of the first part in performing or furnishing any work or materials to be performed or furnished by the party of the first part in connection with the execution of the work covered by this contract.

### **Article XIX. Character of Workmen.**

The Contractor shall employ only competent men to do the work, and whenever the Engineer shall notify the Contractor in writing, that any man on the work is, in his opinion, incompetent, unfaithful, disorderly or otherwise unsatisfactory, or not employed in accordance with the provisions of Article XXI, such man shall be discharged from the work, and shall not again be employed on it except with the consent of the Engineer.

### **Article XX. Workmen's Compensation.**

The Contractor agrees to take out and maintain, at his own expense, insurance against damages arising from injury to his employees, in accordance with Chapter 152 of the General Laws, and any amendments thereof, and to comply with all the requirements thereof.

### **Article XXI. Preference in Employment of Labor. Eight-Hour Law.**

The Contractor, in the construction of the work herein contracted for, in the employment of mechanics, teamsters and laborers, shall give preference first, to citizens of the Commonwealth who have served in the army or navy of the United States in time of war and have been honorably discharged therefrom, or released from active duty therein, and who are qualified to perform the work to which the employment relates, and second, to citizens of the Commonwealth generally, and if they cannot be had in sufficient numbers, then to citizens of the United States.

No laborer, workman or mechanic working within this Commonwealth in the employ of the Contractor, sub-contractor or other person doing or contracting to do the whole or a part of the work contemplated by this contract, shall be required, or permitted to work more than eight hours in any one day or more than forty-eight hours in any one week, except in cases of extraordinary emergency. Every employee in the work covered by this contract shall lodge, board and trade where and with whom he elects, and neither the Contractor nor his agents or employees shall directly or indirectly require as a condition of employment therein that an employee shall lodge, board or trade at a particular place or with a particular person.

### **Article XXII. Preference in Awarding of Contracts.**

The Contractor shall comply with the provisions of Chapter 149 of the General Laws as amended by Chapter 517 of the Acts of 1922 relative to giving such preference to citizens in awarding contracts for public work as is therein provided.

### **CHAPTER 517 OF THE ACTS OF 1922.**

Chapter one hundred and forty-nine of the General Laws is hereby amended by inserting after section one hundred and seventy-nine the following new section:—*Section 179A.* In the awarding of contracts for public work by the Commonwealth or by a county, city or town or by persons contracting therewith to do such work, preference shall be given to persons who are citizens of the United States and to partnerships all of whose members are such citizens. Any person who knowingly and wilfully violates this section shall be punished by a fine of not more than two hundred dollars. Nothing in this section shall require the acceptance of a higher bid in preference to a lower bid. [Approved June 8, 1922.]

### **Article XXIII. Co-operation of Contractor.**

The Contractor shall provide all reasonable facilities to enable the Engineer to inspect the workmanship and materials entering into the work, and shall co-operate in the matter of setting and preserving stakes, bench marks, etc., for controlling the work.

Whenever the Contractor is not present on any part of the work where it may be desired to give directions, orders will be given by the Engineer, and shall be received and obeyed by the superintendent or foreman who may have charge of the particular work in reference to which the orders are given.

#### **Article XXIV. Contractor to Inform Himself of Laws.**

The Contractor shall keep himself fully informed of all existing and future state and national laws and municipal ordinances and regulations in any manner affecting those engaged or employed in the work, or the materials used in the work, or in any way affecting the conduct of the work, and of all such orders and decrees of bodies or tribunals having any jurisdiction or authority over the same. If any discrepancy or inconsistency is discovered in the contract, plans, drawings or specifications for this work in relation to any such law, ordinance, regulation, order or decree, he shall forthwith report the same to the Engineer in writing. He shall at all times himself observe and comply with, and shall cause all his agents and employees to observe and comply with, all such existing and future laws, ordinances, regulations, orders and decrees; and shall protect and indemnify the Town, the party of the first part, the Engineer and all of its and their officers and agents and servants against any claim or liability arising from or based on the violation of any such law, ordinance, regulation, order or decree, whether by himself or his employees or sub-contractors.

#### **Article XXV. Public Safety and Protection of Work.**

The Contractor shall take all responsibility for the work, and take all precautions for preventing injuries to persons and property in or about the work.

The Contractor shall at his own expense provide, place and erect all necessary barricades and warning signs, and furnish and keep lighted all lanterns necessary to protect the work from traffic, pedestrians and animals.

The Contractor shall also furnish at his own expense a sufficient number of watchmen at all times to regulate traffic and protect the work.

#### **Article XXVI. Preservation of Trees.**

The Contractor shall, at his own expense, preserve and protect from injury by horses or vehicles all roadside trees. If so directed by the Engineer he shall cover the trunks with burlap, or shall drive stakes around them in a manner satisfactory to the Engineer.

#### **Article XXVII. Responsibility for Damage.**

The Contractor shall bear all losses resulting to him on account of the amount or character of the work, or because the nature of the land in or on which the work is done is different from what was estimated or expected, or on account of the weather, elements or other cause; and he shall assume the defence of, and indemnify and save harmless, the Town and the party of the first part and its officers and agents, from all claims relating to labor and materials furnished for the work; to injuries to any person or corporation received or sustained by or from the Contractor and his employees in doing the work, or in consequence of any improper materials, implements or labor used therein; and to any act, omission or neglect of the Contractor and his employees therein.

#### **Article XXVIII. Tests of Materials.**

All tests of materials shall be made by the party of the first part or under its direction. The Contractor shall afford such facilities as the Engineer may require for collecting and forwarding samples.

#### **Article XXIX. Quality of Materials.**

All materials used in the work shall meet the requirements of the specifications.

#### **Article XXX. Storage of Materials.**

Materials shall be stored at the expense of the Contractor so as to insure the preservation of their quality and fitness for the work. When considered necessary, by the Engineer, they shall be placed on wooden platforms, or other hard, clean surfaces and not on the ground, and shall be placed under cover when directed. Stored materials shall be so located as to facilitate prompt inspection.

#### **Article XXXI. Lines, Grades and Measurements.**

The Contractor is to furnish, free of charge, all stakes and such temporary structures as may be necessary for marking and maintaining points and lines given by the Engineer for the building of the work, and is to give said Engineer such facilities and materials for giving said lines and points as he may require; and the Engineer's marks must be carefully preserved.

#### **Article XXXII. Engineer as Referee.**

The Engineer shall decide all questions which may arise as to the quantity, quality, acceptability, fitness and rate of progress of the several kinds of work and materials to be performed and furnished under this contract, and shall decide all questions which may arise as to the interpretation of the plans and specifications used as to the fulfillment of this contract on the part of the Contractor, and his determination and decision shall be final and conclusive; and such determination and decision, in case any question shall arise, shall be a condition precedent to the right of the Contractor to receive any money hereunder.

#### **Article XXXIII. Inspection of Materials and Work.**

The party of the first part and the engineers, agents and employees of the party of the first part may for any purpose enter upon the work and premises used by the Contractor, and the Contractor shall provide safe and proper facilities therefor.

The inspection of the work shall not relieve the Contractor of any of his obligations to fulfill his contract as herein prescribed, and defective work shall be made good and unsuitable materials may be rejected, notwithstanding that such work and materials have been previously overlooked by the Engineer and accepted or estimated for payment. If the work or any part thereof shall be found defective at any time before the final acceptance of the whole work, the Contractor shall forthwith make good such defect, in a manner satisfactory to the Engineer, and if any material brought upon the ground for use in the work, or selected for the same, shall be condemned by the Engineer as unsuitable or not in conformity with the specifications, the Contractor shall forthwith remove such materials from the vicinity of the work. Nothing in this contract shall be construed as vesting in the Contractor any right of property in the materials used after they have been attached or affixed to the work or the soil; but all such materials shall, upon being so attached or affixed, become the property of the Town.

#### **Article XXXIV. Final Cleaning Up.**

Upon completion of the work and before acceptance and final payment, the Contractor shall remove, at his own expense, from the highway and from adjoining property, all temporary structures and all surplus material and rubbish which may have accumulated during the prosecution of the work, and shall leave the work in a neat and orderly condition.

#### **Article XXXV. Failure to Complete Work on Time.**

The Contractor shall pay to the Town all expenses, losses and damages, as determined by the Engineer, incurred in consequence of any defect, omission or mistake of the Contractor or his employees.

In case the work embraced in this contract shall not be completed by the time herein appointed, the Contractor shall pay to the Town the sum of twenty-five (25) dollars for each and every day thereafter (not including Sunday) until and including the day when said work shall be completed.

Whatever sum of money may become due and payable to the Town by the Contractor under this article may be retained out of money in the hands and possession of the Town belonging to the Contractor; and it is agreed that this article is to be construed and treated both by the parties to this contract and by all courts of law or equity, not as imposing a penalty upon said Contractor for failing to fully complete said work as agreed on or before the time herein appointed, but as providing for liquidated damages to compensate said Town for all damages actually suffered because of the failure of the Contractor to fully complete said work as above agreed on or before said day.

Permitting the Contractor to continue and finish the work or any part of it, after the time fixed for its completion, or after the date to which the time for completion may have been extended, shall in nowise operate as a waiver on the part of the Town of any of its rights under this contract.

#### **Article XXXVI. Annulment of Contract.**

If the work to be done under this contract shall be abandoned, or if this contract or any part thereof shall be sublet, without the previous written consent of the party of the first part, or if the contract or any claim thereunder shall be assigned by the Contractor otherwise than as herein specified, or if at any time the Engineer shall be of opinion, and shall so certify in writing to the party of the first part, that the work, or any part thereof, is unnecessarily or unreasonably delayed, or that the Contractor has violated any of the provisions of this contract, the party of the first part may notify the Contractor to discontinue all work, or any part thereof; and thereupon the Contractor shall discontinue such work or such part thereof as the party of the first part may designate, and the party of the first part may thereupon, by contract or otherwise, as it may determine, complete the work, or such part thereof, and charge the entire expense of so completing the work or part thereof to the Contractor; and for such completion the party of the first part for itself or its agents may take possession of and use or cause to be used in the completion of the work or part thereof any of such materials, animals, machinery, implements and tools of every description as may be found upon the line of said work.

All expenses charged under this article shall be deducted and paid by the Town out of any moneys then due or to become due the Contractor under this contract, or any part thereof; and in such accounting the party of the first part shall not be held to obtain the lowest figures for the work of completing the contract or any part thereof, or for insuring its proper completion, but all sums actually paid therefor shall be charged to the Contractor. In case the expenses so charged are less than the sum which would have been payable under this contract if the same had been completed by the Contractor, the Contractor shall be entitled to receive the difference; and in case such expenses shall exceed the said sum, the Contractor shall pay the amount of the excess to the Town upon completion of the work, without further demand being made therefor.

#### **Article XXXVII. Partial Payments.**

The Engineer shall, once in each month, make an estimate in writing of the total amount of the work done to the time of such estimate and the value thereof. The Town shall retain fifteen per cent of such estimated value as part security for the fulfillment of this contract by the Contractor, and shall monthly pay to the Contractor while carrying on the work the balance not retained as aforesaid, after deducting therefrom all previous payments and all sums to be kept or retained under the provisions of this contract. No such estimate or payment shall be required to be made when, in the judgment of the Engineer, the work is not proceeding in accordance with the provisions of this contract, or when in his judgment the total value of the work done since the last estimate amounts to less than three hundred (300) dollars. The party of the first part may, if it deems it expedient so to do, cause estimates to be made more frequently than once in each month, and it may cause payments to be made more frequently to the Contractor. The party of the first part may at its option retain, temporarily or permanently, a smaller amount than as aforesaid, and may cause the Contractor to be paid, temporarily or permanently, from time to time such portion of the reserve as it deems prudent.

#### **Article XXXVIII. Final Payment.**

The Engineer shall, as soon as practicable after the completion of this contract, make a final estimate of the amount of work done thereunder and the value of such work, and the Town shall, after the expiration of sixty-five days from and after the work has been approved by the party of the first part, pay the entire sum so found to be due hereunder after deducting therefrom all previous payments and all amounts to be kept and all amounts to be retained under the provisions of this contract. All prior partial estimates and payments shall be subject to correction in the final estimate and payment.

#### **Article XXXIX. Legal Rights not Waived.**

Neither the inspection of the party of the first part, or Engineer, or any of its employees, nor any order, measurement or certificate by the Engineer, nor any order by the party of the first part for the payment of money, nor any payment for, or acceptance of, the whole or any part of the work by the Engineer or party of the first part, nor any extension of time, nor any possession taken by the party of the first part or its employees, shall operate as a waiver of any provision of this contract, or of any power herein reserved to the party of the first part, or any right to damages herein provided; nor shall any waiver of any breach of this contract be held to be a waiver of any other or subsequent breach. Any remedy provided in this contract shall be taken and construed as cumulative, that is, in addition to each and every other remedy herein provided; and the Town and the party of the first part shall also be entitled as of right to a writ of injunction against any breach of any of the provisions of this contract.

#### **Article XL. Release from Claim and Liability to Contractor.**

No person or corporation, other than the signer of this contract as Contractor, now has any interest hereunder, and no claim shall be made or be valid, and neither the Town nor the party of the first part, nor any member, agent or employee thereof, shall be liable for, or be held to pay, any money, except as provided in Articles XIII, XV, XVI, XXXVI, XXXVII and XXXVIII and Clause 3 of the Contract.

All claims of the Contractor for compensation other than as provided for in this contract on account of any act or omission or commission by the party of the first part or of its agents must be made in writing to the Engineer within one week after the beginning of any work or the sustaining of any damage on account of such act, such written statement to contain a description of the nature of the work performed or damage sustained; and the Contractor shall, on or before the fifteenth day of the month succeeding that in which such work is performed or damage sustained, file with the Engineer an itemized statement of the details and amount of such work or damage. Unless such statement shall be made as so required, his claim for compensation shall be forfeited and invalid, and he shall not be entitled to payment on account of any such work or damage. The determination of the Engineer shall be final upon all questions of the amount and value of such work, and as to the fact and extent of such damage. The acceptance by the Contractor of the last payment made under the provisions of Article XXXVIII, shall operate as and shall be a release to the Town, the party of the first part, and every member, agent and employee thereof, from all claim and liability to the Contractor for anything done or furnished for, or relating to, the work, or for any act or neglect of the Town or of any person relating to or affecting the work, except the claim against the Town for the remainder, if any there be, of the amounts kept or retained as provided in Article XLII.

#### **Article XLI. Foreign Corporations.**

The Contractor, if a foreign corporation, shall comply with the provisions of sections three and five of chapter one hundred and eighty-one of the General Laws, and acts in amendment thereof and in addition thereto.

#### **Article XLII. Claims against Contractor.**

Said Contractor shall pay all bills for labor and materials contracted by him on account of the work herein contemplated. The Town or the party of the first part may keep any moneys which would otherwise be payable at any time hereunder, and apply the same, or so much as may be necessary therefor, to the payment of any expenses, losses or damages incurred by the Town or the party of the first part, and determined as herein provided, and may retain, until all claims are settled, so much of such moneys as the party of the first part shall be of opinion will be required to settle all claims against the Town and the party of the first part and their officers and agents, specified in Article XXVII, and all claims for labor performed or furnished and for materials used or employed, filed with the party of the first part in accordance with section twenty-nine of chapter one hundred forty-nine of the General Laws, or the party of the first part may make such settlements and apply thereto any moneys retained under this contract. If the moneys retained under this contract are insufficient to pay the sums found by the party of the first part to be due under the claims for labor and materials filed as aforesaid, the Town or the party of the first part may, at its discretion, pay the same, and the Contractor shall repay to the Town or the party of the first part all sums so paid. The Town or the party of the first part may also, with the written consent of the Contractor, use any moneys retained, due or to become due under this contract, for the purpose of paying for labor and materials for the work, for which claims have not been filed in the office of the party of the first part. It is understood that the security required by section twenty-nine of chapter one hundred and forty-nine of the General Laws is obtained both by the bond accompanying this contract and by the power of the Town and the party of the first part to retain and pay money under the provisions of this article, but the release of one shall in no way impair or discharge the other.

#### **Article XLIII. Indemnification of the Town.**

The Contractor shall be responsible for any and all claims made against the Town or its officers, servants or agents, for any infringement of patents by the use of patented articles in the construction and completion of the work or any process connected with the work agreed to be performed under this contract, or of any materials used upon the said work, and shall indemnify and save harmless the Town and its officers, servants and agents, for the costs, expenses and damages which the Town or its officers, servants and agents, may be obliged to pay by reason of any infringement of patents used in the construction and completion of the work.

## **CONSTRUCTION DETAILS.**

#### **ARTICLE XLIV. CONSTRUCTION DETAILS.**

##### **Excavation and Embankment.**

**Section 1. DESCRIPTION.** Excavation and Embankment shall consist of grading the roadway in conformity with the plans, true to the lines and grades given. This grading shall include all clearing and grubbing (unless otherwise provided herein), excavating, forming embankments, shaping and sloping, compacting and other work that may be necessary in bringing the roadway and its appurtenances to the required grade, alignment and cross-section, also the grading of all intersecting roadways, driveways and approaches, and excavating all foundations for structures. This work shall be done in accordance with these specifications.

**Section 2. CLEARING AND GRUBBING.** All trees, stumps, brush, roots, rubbish, etc., shall be cut, grubbed and removed from the roadway except as herein provided. All brush shall be burned completely, upon the location by the Contractor immediately after cutting. In all excavations, and under all embankments of two (2) feet or less, the stumps of all trees or brush shall be grubbed together with their major roots. Under embankments of more than two (2) feet in depth, all stumps and brush shall be cut flush with the ground surface, within the area covered by embankments, berms and ditches. No perishable matters, such as stumps, bodies or limbs of trees or brush shall remain within the slope stakes or be incorporated within the embankments. All slopes of cuts, embankments, ditches and waterways, and all culverts and bridges, whether old or new, shall be cleaned and cleared of obstructions in a satisfactory manner and shall be left in a neat and trimmed condition. Such trees or shrubs as may be designated by the Engineer shall not be cut off but shall be saved from harm during the construction of the work.

**Section 3. ROADWAY EXCAVATION.** Roadway excavation shall include the removal and satisfactory disposal of all materials obtained within the limits of the location and slopes, side roads and driveways, necessary for the construction of any part of the proposed work, excepting that for the construction of bridges, pipe culverts, catch basins, side drains, curb inlets and for other work as hereinafter specified.

All suitable materials removed from the excavation shall be used as far as practicable in the formation of the embankments, sub-grade, shoulders, etc., and at such other places as directed by the Engineer.

Ditches of such width and depth as the Engineer may direct shall be excavated by the Contractor wherever the Engineer may order them.

All slopes, ~~whether old or new~~, shall be left with neat and even surfaces, according to the lines, grades and directions given by the Engineer, without additional compensation.

Earth excavation for roadways and structures shall include material such as clay, sand, gravel, loam or decomposed rock, boulders of less than one-half ( $\frac{1}{2}$ ) cubic yard in volume, and all other materials not classified as ledge excavation.

Wherever there is excavation for streams or ditches, whether within or outside of the highway location including excavation for new channels leading to or from bridges and culverts but not including excavation for bridge structures, as defined elsewhere in these specifications as excavation for structures, it shall be paid for as roadway excavation.

Ledge excavation for roadway shall include only such ledge as requires blasting for its removal, and boulders of one-half ( $\frac{1}{2}$ ) a cubic yard or more in volume.

No allowance for ledge excavation in the road-bed shall be made outside of the lines indicated on the cross-sections showing the side slopes, said slopes to be one-quarter ( $\frac{1}{4}$ ) to one (1); nor for more than six (6) inches below the sub-grade line.

Allowance for ledge in gutters will be made on the basis of the width of the gutter and twelve (12) inches in depth below the proposed surface.

Material obtained from ledge excavation shall be used to form the necessary embankments when so directed by the Engineer.

Ledge or stone taken by the Contractor from within the slope lines of the section under contract and used by him for any other purpose than for forming embankments shall be replaced by an equal amount of material (as measured in excavation), satisfactory to the Engineer, at the expense of the Contractor, provided such use necessitates securing additional material for forming embankments.

**Section 4. EXCAVATION FOR STRUCTURES.** Excavation for foundations for culverts, bridges and other structures shall be made to the depth and lines indicated on the plans or established by the Engineer.

The material obtained from such excavation shall be used as the Engineer may direct, either in constructing embankments or for backfilling over and around the structures after they are complete, or in case it is unsuitable for either of these purposes, it shall be disposed of in such manner as not to obstruct the stream or otherwise impair the efficiency or appearance of the structure or other parts of the road. All backfilling shall be made with suitable material, uniformly distributed and tamped. Both sides of the opening shall be backfilled, to the same elevation, at the same time and thoroughly tamped.

Bridge excavation shall include the removal and satisfactory disposal of all materials in existing sub-structures and of all other materials, except ledge, that are removed in the construction of abutments, wing walls and piers, within one (1) foot outside of the base of the same as shown on the plans.

Allowance for earth excavation for culverts (except pipe culverts), bridges and walls will include only one (1) foot outside of the base of the masonry sections shown on the plans.

Ledge excavation for structures shall include all the masonry removed from the existing walls and covers of culverts but no masonry of bridges, and shall include all such ledge as requires blasting for its removal and boulders of  $\frac{1}{2}$  cu. yd. or more in volume, said ledge and boulders not being a portion of the masonry removed.

Culverts are structures having a clear span of 8 ft. or less. Bridges are structures having a clear span of over 8 ft.

**General Conditions for Bridges.** If the condition of the bottom of excavation for foundations of abutments and wing walls and pier is wet or spongy or otherwise unsatisfactory to the Engineer, he may require that the bottom be excavated deeper and the space filled with

a — Clean gravel, or

b — Rubble concrete masonry, or

c — Plain concrete masonry, or

d — Clean gravel in the bottom with rubble concrete masonry on top; the gravel or the concrete to be tamped and leveled to the sub-grade of the concrete foundations. The excavation shall be paid for at the contract unit price per cubic yard for Bridge Excavation; the gravel shall be paid for at the contract unit price per cubic yard for Gravel Borrow and the concrete shall be paid for at the contract unit price per cubic yard for the particular class of Concrete Masonry used.

When stone walls, not in culverts or bridge structures, are removed, and not relaid, all stones measuring less than  $\frac{1}{2}$  cu. yd. in volume so removed shall be paid for as roadway earth excavation and when measuring  $\frac{1}{2}$  cu. yd. or more in volume shall be paid for as ledge excavation.

Allowance for ledge excavation in all culverts, bridges and catch basins will be made on a basis of six (6) inches outside of the outer walls.

In calculating excavation for structures the sides of the excavation will be considered vertical.

No allowance will be made for cofferdams, pumps, pumping or bailing, or for any materials (except concrete), equipment or labor necessary on account of water, or unstable materials.

When directed by the Engineer, the Contractor shall submit plans of the cofferdam which he proposes to use and shall not proceed with its construction until such plans have been approved by the Engineer.

If directed by the Engineer a layer of concrete shall be placed in the water on the bottom with a bottom dumping bucket, or by other methods satisfactory to the Engineer.

**Section 5. EMBANKMENTS.** Embankments shall be formed of successive layers of not more than twelve (12) inches in thickness, each layer to be thoroughly rolled by a roller weighing not less than two tons.

Stumps, rubbish, sod or any other unsuitable materials shall not be placed in the embankment.

**Section 6. DISPOSAL OF SURPLUS MATERIAL.** All surplus excavations shall be used uniformly to widen embankments or flatten side slopes, or deposited in such other places and for such purposes as the Engineer may direct. When such surplus material cannot be used within the location, it shall be disposed of outside of the location by the Contractor without additional compensation.

**Section 7. BORROW.** When, in the opinion of the Engineer, there is not sufficient suitable material available either within the slope lines of the section under contract or within the limits of the highway location to form the necessary embankments, or for sub-grading, or for shoulders, the Contractor shall obtain such additional material as may be necessary from outside the highway location. This material shall be known as borrow, and may be of any quality satisfactory to the Engineer for the purpose for which it is required.

Ordinary borrow shall consist of any material of a quality satisfactory to the Engineer not particularly specified as gravel borrow, sand borrow, or other particular kind of borrow.

When gravel, sand or other material obtained from outside the limits of the highway location or outside of the slope lines is specified for use in the sub-base, shoulders, filling voids in stone base or for any other purpose and for which the ordinary borrow is not suitable, such gravel, sand or other material shall be classified as gravel borrow, sand borrow, etc.

In order that gravel borrow to be taken from the pits may be secured free from loam or other objectionable material lying above it, such material shall be excavated and removed from the gravel borrow pit, and shall be classified as Stripping of Gravel Borrow Pits. This stripping shall be removed to such depth as the Engineer may direct. In the event of its being necessary to move such stripping twice, the Contractor will only be paid for stripping once. The stripping shall be measured in its original position by the cross-section method, and a unit price established and paid amounting to twenty (20) cents per cubic yard. Whenever such stripping is suitable and the Engineer may direct, it shall be used as ordinary borrow and not paid for as stripping but paid for at the contract unit price for ordinary borrow. The unit price per cubic yard to be paid for gravel borrow, ordinary borrow or stripping, as the case may be, shall include all grubbing and clearing.

~~Section 8. Overhaul. An overhaul allowance will be made for all borrow hauled over five thousand (5,000) feet, the length of haul to be measured from the pit along the nearest available route to the point at which the material is used, deducting five thousand (5,000) feet for free haul.~~

~~Section 9. SUB-GRADE. The plane of the bottom of the excavation and the top of the fill when completed shall be known as the sub-grade, and shall be true to the lines, grades and cross-sections given.~~

All clay and spongy material in the road-bed shall be removed to a depth to be determined by the Engineer, and the space thus made shall be filled with such material as the Engineer may direct.

Before the surfacing is spread the road-bed shall be shaped to a true surface conforming to the proposed cross-section of the highway and rolled by a steam or other self-propelled roller, weighing not less than ten (10) tons.

All depressions occurring must be filled with suitable material and again rolled until the surface is smooth and hard.

Any portion of the sub-grade which is not accessible to a roller shall be compacted thoroughly with hand tampers weighing not less than fifty (50) pounds, the face of which shall not exceed a hundred (100) square inches in area.

The cost of shaping and rolling the road-bed shall be included in the price paid for excavation and for furnishing the material used, and shall not be additional thereto.

~~Steam rollers, steam boilers and steam shovels shall be equipped with spark arresters.~~

~~Section 10. SHOULDERS. Shoulders shall be formed so as to hold the surfacing material of the roadway pavement in its proper place. They shall be composed of excavated material or borrow or when the material in cuts is suitable it shall be shaped so as to form the shoulder.~~

The surface of the shoulder when finished shall conform to the proposed grade and cross-section. Before the final completion of the work, the shoulders shall be reformed, trimmed, raked and rolled.

~~Section 11. METHOD OF DETERMINING EXCAVATION AND BORROW QUANTITIES. All excavation and borrow will be measured in its original position by the cross-section method.~~

~~Section 12. BASIS OF PAYMENTS. Payments for the foregoing work shall be made as follows:~~

~~(a) Roadway Excavation. All "roadway excavation," including excavation of all intersecting roadways, driveways, approaches, ditches and culverts, except pipe culverts, which is composed of all material except ledge shall be paid for at the contract unit price per cubic yard of roadway earth excavation; if composed of ledge it shall be paid for at the contract unit price per cubic yard of ledge excavation. These prices shall include all clearing and grubbing (except as may be otherwise provided herein), all excavation within the limits of the work contracted for, formation of embankments, disposal of surplus material, preparation of sub-grade and shoulders and the furnishing of all equipment, tools, labor and work incidental thereto.~~

~~(b) Shoulders. Shoulders shall be paid for at the contract unit price per cubic yard for roadway earth excavation when composed of material obtained from excavation, and when composed of borrow they shall be paid for at the contract unit price per cubic yard of borrow of the kind used.~~

The reforming, trimming and rolling of shoulders shall be paid for at the contract unit price per lineal foot for reforming, trimming and rolling shoulders.

~~(c) Excavation for Structures. Excavation for bridges if composed of material, except ledge, as specified under Section 4, shall be paid for at the contract unit price per cubic yard of bridge excavation.~~

Ledge excavation for culverts and bridges and other structures shall be paid for at the contract unit price per cubic yard of ledge excavation.

These prices shall include all clearing and grubbing (except as may be otherwise provided herein), all excavation for the structure, formation of embankments, disposal of surplus material, and the furnishing of all equipment, tools, labor and work incidental thereto.

In excavation for structures in cuts the material excavated above the sub-grade line of the roadway shall be paid for as roadway excavation only.

In excavation for structures where an embankment is proposed the depth shall be measured from the bottom of the embankment to the bottom of the foundation. The earth excavation for pipe culverts (excepting as herein otherwise specified) and catch basins shall be paid for in the contract unit price for these structures.

~~(d) Borrow. All borrow shall be paid for at the contract unit price per cubic yard for borrow, of the kind specified, which price shall include furnishing and placing the material, and all equipment, tools, labor and work incidental thereto.~~

~~(e) Overhaul. The sum of one-half cent ( $\frac{1}{2}c$ ) per cubic yard for each one hundred (100) feet beyond the free haul mentioned in Section 8 shall be paid for overhaul.~~

If the Contractor obtains borrow from a source at a greater distance from a point where it is used than where in the opinion of the Engineer suitable borrow may be obtained, no greater overhaul allowance will be paid than would be paid if the borrow were taken from the nearest source that is satisfactory to the Engineer.

When borrow which in the opinion of the Engineer is suitable can be obtained within the distance mentioned in Section 8 from the pit to the point where it is used, no overhaul allowance will be made for borrow obtained at a greater distance.

~~Payment will be estimated by interval yards, each interval yard being equal to one (1) cubic yard for each one hundred (100) feet of overhaul.~~

~~(f) Trees. The removal of such trees as have the shortest diameter, as measured three feet above the ground, of nine (9) inches or more, including the removal of stumps thereof, shall be paid for at the contract unit price each.~~

#### Sub-base.

~~Section 13. DESCRIPTION. The sub-base shall consist of approved stone and gravel, or gravel, placed in excavation made by the removal of soft, unstable or other unsuitable sub-grade materials and shall be constructed as shown on plans and in accordance with these specifications.~~

~~Section 14. MATERIALS. The stone to be used shall consist of suitable ledge or field stone, satisfactory to the Engineer.~~

The stones shall not exceed twelve (12) inches in their longest dimension and be not less than one and one-half ( $1\frac{1}{2}$ ) inches in their smallest dimension. About 50 per cent of the stone shall be six (6) inches or more in its longest dimension. The gravel

shall be composed of hard, durable stone, practically free from loam and clay, with all stone having a dimension larger than four (4) inches removed.

When cobble or rounded stones are used, a sufficient number of these shall be broken to permit satisfactory rolling.

**Section 15. CONSTRUCTION METHODS.** All clay, spongy or other unsuitable material shall be removed to a depth to be determined by the Engineer and the space thus made shall be filled with such sub-base material as the Engineer may direct.

Gravel shall be placed under the stone filling to such width and depth as the Engineer directs, and thoroughly rolled with a steam or other self-propelled roller. The larger stones of the stone filling shall be placed at the bottom of the stone filling and shall rest firmly on their largest face with sufficient smaller stone over, between and around them to so chink and true up the finished course that after rolling is completed the visible interstices shall not exceed two and one-half (2½) inches in width or depth. No stone shall extend more than two-thirds (⅔) of the distance from bottom to top of the stone filling.

After the stone filling is placed to the depth required it shall be thoroughly rolled with a steam or other self-propelled roller weighing not less than ten (10) tons.

There shall then be spread over it clean sandy gravel which shall be rolled and broomed into the interstices until all voids are filled. All surplus gravel shall then be swept off leaving the surface of the stone bare.

The stone filling will be measured according to the cross-sections ordered, without allowance for shrinkage or settlements.

If the Contractor takes stone for the stone filling from within the slope lines of the highway under construction, the Contractor shall at his own expense furnish an amount of borrow, of a quality satisfactory to the Engineer, equal to the amount of stone taken, as measured in excavation, if needed for embankment or other purposes.

If gravel is used for the sub-base it shall be spread uniformly, with no segregation of large or fine particles, and rolled with a steam or other self-propelled roller weighing not less than ten (10) tons, until a firm, even surface is obtained.

**Section 16. BASIS OF PAYMENT.** The excavation for the sub-base shall be paid for at the contract unit price per cubic yard of roadway earth excavation or ledge excavation depending upon the character of the materials removed.

The stone filling shall be paid for at the contract unit price per cubic yard for stone filling, complete in place. The gravel shall be paid for at the contract unit price per cubic yard for gravel borrow, excepting that gravel found within the location of the highway and used in the sub-base shall be paid for as roadway earth excavation only.

The above prices for sub-base material shall include all materials, equipment, tools, labor and work incidental thereto.

#### Gravel Surfacing.

**Section 17. DESCRIPTION.** Gravel surfacing shall consist of approved gravel placed upon the sub-grade or upon the sub-base as directed by the Engineer and in accordance with these specifications.

The width and the depth (after rolling) of the gravel course shall be as shown on the plans.

**Section 18. MATERIAL.** The gravel shall be composed of hard, durable stone practically free from loam and clay and shall contain no stones measuring over three (3) inches in their longest dimensions.

**Section 19. CONSTRUCTION METHODS.** Upon the sub-grade or sub-base, prepared as hereinbefore specified, the gravel shall be spread from a dumping board and care shall be taken while spreading the gravel to rake forward and distribute the largest stones so that they will be at the bottom of the gravel course and be evenly distributed. The gravel so placed shall be thoroughly watered and rolled with a steam or other self-propelled roller to the satisfaction of the Engineer. Any depressions that appear during or after rolling shall be filled with gravel and rerolled until the surface is true and even.

**Section 20. BASIS OF PAYMENT.** The work shall be paid for at the contract unit price per cubic yard for gravel surfacing, complete in place, which price shall include all materials, tools, labor and work incidental thereto (except overhaul).

The gravel used for surfacing shall be measured in its original position by the cross-section method.

The overhaul on this material shall be as specified in Section 8 and Section 12 (e).

#### Waterbound Macadam.

**Section 21. DESCRIPTION.** Waterbound macadam shall consist of broken stone spread, rolled, and watered upon the sub-grade or upon the sub-base as directed by the Engineer and in accordance with these specifications.

The width and the depth (after rolling) of the waterbound macadam shall be as shown on the plans.

**Section 22. MATERIALS.** The stone used shall have a French coefficient of wear not less than 10 and a toughness not less than 8. No soft or disintegrated stone shall be used. The broken stone shall be designated as No. 1, No. 2 and screenings. No. 1 shall consist of stone that will pass through a ring two and one-half (2½) inches in diameter and will not pass through a ring one and one-quarter (1¼) inches in diameter. No. 2 shall consist of stone that will pass through a ring one and one-quarter (1¼) inches in diameter but will not pass through a ring one-half (½) inch in diameter. Screenings shall not be larger than will pass through a half inch mesh and shall contain all the dust.

**Section 23. CONSTRUCTION METHODS.** Upon the sub-grade or sub-base prepared as hereinbefore specified, the broken stone shall be spread and rolled in two layers or courses. The lower course shall consist of No. 1 and No. 2 stone in such proportions as the Engineer directs.

The upper course shall consist of No. 1 stone. The thickness of the upper and lower courses shall be as directed by the Engineer. If so ordered by the Engineer the thickness of the broken stone shall be increased or diminished at such points as he may direct.

All broken stone shall be spread from the carts by hand or from a dumping board or from self-spreading carts of a type approved by the Engineer.

After the two courses above described are thoroughly compacted, broken stone screenings shall be thinly spread over the stone surface, watered and rolled until the mud flushes to the surface. As the stone screenings are watered and rolled, voids between the larger stones will appear in the surface and this operation of thinly spreading the screenings, watering and rolling and flushing out, shall be continued until the surface is completed to the satisfaction of the Engineer. Whenever the Engineer may direct roads shall be allowed to dry out between periods of watering and rolling. Each course, bottom, top and binder, shall be rolled separately by a steam or other self-propelled roller weighing not less than ten (10) tons, and evened up with material of the same size and quality as has been used in that particular course, and to the satisfaction of the Engineer.

If local stone or stone not shipped by rail is used it shall be weighed on scales furnished by and at the expense of the Contractor. Said scales shall be sealed at the expense of the Contractor as often as the Engineer may deem necessary to insure their accuracy. A sworn weigher to be appointed and compensated by the Department shall weigh all broken stone required to be weighed as above provided.

If the stone is shipped by rail the car weights may be accepted, but scales shall be used as above provided if the Engineer so directs.

**Section 24. BASIS OF PAYMENT.** This work shall be paid for at the contract unit price per ton for broken stone rolled, complete in place, which price shall include all materials, equipment, tools, labor and work incidental thereto.

### Bituminous Surface Treatment.

**Section 25. DESCRIPTION.** After the road has been surfaced with Gravel or with Water Bound Macadam as hereinbefore specified, a bituminous surface treatment shall be applied (if required under "Special Provisions") in accordance with these specifications.

**Section 26. MATERIALS.** The bituminous material shall consist of tar or asphaltic oil; the kind to be used and the number of gallons to be applied per square yard will be given under "Special Provisions."

The tar shall be homogeneous.

It shall meet the following requirements:

1. Specific gravity 25°/25° C. (77°/77° F.)	.....	not less than 1.100
2. Specific viscosity at 40° C. (104° F.)	.....	8 to 17
3. Total distillate by weight:		
To 170° C. (338° F.)	.....	not more than 5 per cent.
To 270° C. (518° F.)	.....	not more than 30 per cent.
To 300° C. (572° F.)	.....	not more than 40 per cent.
4. Total bitumen (soluble in carbon disulphide).	.....	not less than 88 per cent.

Asphaltic oil shall be homogeneous and free from water.

It shall meet the following requirements:

1. Specific gravity 25°/25° C. (77°/77° F.) = 0.92-0.970
2. Flash point not less than = 50° C. (122° F.)
3. Specific viscosity at 25° C. (77° F.) = 30 to 65
4. Loss at 163° C. (325° F.) 5 hours, not more than = 30%
5. Total Bitumen (soluble in carbon disulphide) not less than = 99.5%
6. Total Bitumen insoluble in 86° B naphtha, not less than = 6.0%
7. The asphaltic content at 100 penetration shall be between = 45%-55%

The sand shall consist of grains or particles of quartz or other hard and durable rocks. The grains shall be sharp, free from loam and clay or other foreign materials.

**Section 27. CONSTRUCTION METHODS.** The surface of the roads shall be swept of all loose material with brooms or a horse sweeper approved by the Engineer. If directed by the Engineer the road shall then be watered slightly. Upon the surface for the full width two applications of bituminous material hereinbefore described shall be applied cold in a thin film, distributed evenly by means of a pressure machine approved by the Engineer, so designed as to enable its operator to control the flow and to distribute the material uniformly under a pressure of not less than thirty (30) pounds per square inch, leaving no streaks or spots and so designed as to enable its operator to "cut out" any portion of the roadway and to avoid any surplus deposit of the material on the roadway or elsewhere. If the Engineer shall so direct the bituminous material shall also be further distributed by means of soft brooms or squeegees.

After each application of bituminous material as hereinbefore specified, and as soon as may be, a thin layer of sand shall be distributed evenly thereon in sufficient quantity to absorb all surplus bituminous material and form a true surface.

No bituminous work shall be done during rainy weather nor when weather conditions as to temperature or otherwise are in the opinion of the Engineer unfavorable for obtaining satisfactory results.

All unsatisfactory material shall be removed and replaced by and at the expense of the Contractor.

### Section 28. BASIS OF PAYMENT.

This work shall be paid for as follows:

The bituminous material shall be paid for at the contract unit price per gallon applied, complete in place.

The sand shall be paid for at the contract unit price per cubic yard for sand borrow.

The above prices shall include all materials, equipment, tools, labor and work incidental thereto.

### Broken Stone Base Course.

**Section 29. DESCRIPTION.** This base course shall consist of broken stone spread and rolled upon the sub-grade or upon the sub-base as directed by the Engineer and in accordance with these specifications.

The width and the depth (after rolling) of the base course shall be as shown on the plans.

**Section 30. MATERIALS.** ~~The broken stone for the base course shall consist of clean, durable, crushed rock having a French coefficient of wear not less than ten (10) and a toughness not less than eight (8), and shall consist of No. 1 and No. 2 stone. The No. 1 stone shall consist of stone that will pass through a ring two and one-half (2½) inches in diameter and will not pass through a ring one and one-quarter (1¼) inches in diameter.~~

The No. 2 stone shall consist of stone that will pass through a ring one and one-quarter (1¼) inches in diameter but will not pass through a ring one-half (½) inch in diameter.

~~The proportion of No. 1 and No. 2 stone to be used in the base course shall be as directed by the Engineer, the intention being, where stone is crushed locally, to vary the proportions in order to use the output of the crusher.~~

**Section 31. CONSTRUCTION METHODS.** The course shall be shaped to a true section conforming to the proposed cross-section of the highway, and when thoroughly rolled, shall be two (2) inches below and parallel to the proposed finished surface of the surfacing course.

Any depressions or irregularities which may occur shall be filled with broken stone, of such sizes as directed by the Engineer and again rolled until the surface is true and unyielding. The interstices in this course shall then be filled with clean sand, and after being thoroughly rolled the sand shall be just below the top of the broken stone as directed by the Engineer, and no sand shall be left on top of the stones.

All broken stone shall be spread from carts by hand, or from a dumping board, or from self-spreading carts which shall be of a type approved by the Engineer.

If so ordered by the Engineer the thickness of the broken stone shall be increased or diminished at such points as he may direct.

The rolling shall be done by a steam or other self-propelled roller weighing not less than ten (10) tons.

If local stone or stone not shipped by rail is used it shall be weighed on scales furnished by and at the expense of the Contractor. Said scales shall be satisfactory to the Engineer and they shall be sealed at the expense of the Contractor as often as the Engineer may deem necessary to insure their accuracy.

A sworn weigher, to be appointed and compensated by the Department, shall weigh all the broken stone required to be weighed as above provided.

If the stone is shipped by rail the car weights may be accepted, but scales shall be used as above provided if the Engineer so directs.

**Section 32. BASIS OF PAYMENT.** This work shall be paid for at the contract unit price per ton for broken stone rolled, complete in place, which price shall include all materials, equipment, tools, labor, and work incidental thereto.

The sand shall be paid for at the contract unit price per cubic yard for sand borrow, complete in place.

#### Bituminous Macadam Surface Course.

**Section 33. DESCRIPTION.** The bituminous macadam surface shall be laid on a "Broken Stone Base Course" constructed as hereinbefore specified.

The surface course shall be composed of broken stone and bituminous material applied by the penetration method with the bituminous material covered with pea stone.

The width of the bituminous macadam surface course shall be as shown on the plans.

**Section 34. MATERIALS.** The broken stone used shall have a French coefficient of wear not less than ten (10) and a toughness not less than eight (8). No soft or disintegrated stone shall be used.

The stone used shall consist of No. 1 stone, excepting for covering the bituminous material for which pea stone shall be used.

Pea stone shall consist of that portion of the crusher product which will pass a three-quarter ( $\frac{3}{4}$ ) inch screen and will be retained on a quarter inch screen and shall be free from dust.

The bituminous material shall consist of asphalt or refined tar, the kind to be used will be given under "Special Provisions."

Oil asphalt shall be homogeneous, free from water, and shall not foam when heated to 175° C. (347° F.).

It shall meet the following requirements:

1. Specific gravity 25°/25° C. (77°/77° F.)	.....	not less than 1.000
2. Flash point	.....	not less than 175° C. (347° F.)
3. Melting point	.....	35° C. (95° F.) to 55° C. (130° F.)
4. Penetration at 25° C. (77° F.), 100 g., 5 sec.	.....	100 to 120 85 to 100
5. Loss at 163° C. (325° F.), 5 hours	.....	not more than 1.0%
a. Penetration of residue at 25° C. (77° F.), 100 g., 5 sec.	.....	not less than 55
6. Total bitumen (soluble in carbon disulphide)	.....	not less than 99.5%

Organic matter insoluble..... not more than 0.2%

Fluxed native lake asphalt shall be homogeneous, free from water, and shall not foam when heated to 175° C. (347° F.).

It shall meet the following requirements:

1. Specific gravity 25°/25° C. (77°/77° F.)	.....	1.025 to 1.050
2. Flash point	.....	not less than 175° C. (347° F.)
3. Melting point	.....	35° C. (95° F.) to 45° C. (113° F.)
4. Penetration at 25° C. (77° F.), 100 g., 5 sec.	.....	120 to 150
5. Loss at 163° C. (325° F.), 5 hours	.....	not more than 3.0%
a. Penetration of residue at 25° C. (77° F.), 100 g., 5 sec.	.....	not less than 60
6. Total bitumen (soluble in carbon disulphide)	.....	not less than 95.0%

Inorganic matter insoluble..... 1.5% to 2.5%

Refined tar shall be homogeneous and free from water. It shall meet the following requirements:

1. Specific Gravity 25°/25° C.	.....	1.190-1.250
2. Float test at 50° C.	.....	120 sec. to 180 sec.
3. Float distillate by weight:		
To 170° C.	.....	not more than 1.00%
To 270° C.	.....	not more than 10.00%
To 300° C.	.....	not more than 20.00%
a. Melting point of residue	.....	not more than 65° C.
4. Total bitumen (soluble in carbon disulphide)	.....	78% to 97%

**Section 35. CONSTRUCTION METHODS.** Upon the "Broken Stone Base Course" shall be spread an upper course of No. 1 stone which shall be two (2) inches in depth after rolling with a steam or other self-propelled roller weighing not less than ten (10) tons.

The upper course shall be shaped to a true section conforming to the proposed cross-section of the highway, and when thoroughly rolled, shall conform to the proposed grade and cross-section.

Any depressions or irregularities which may occur shall be filled with broken stone, of such sizes as directed by the Engineer, and again rolled until the surface is true and unyielding.

Upon the upper course of stone prepared as above described the bituminous material shall be uniformly applied by a pressure machine at the rate of one and three-quarters ( $1\frac{3}{4}$ ) gallons to each square yard of surface and uniformly covered with clean pea stone in sufficient quantity to fill the surface voids and permit the steam roller to pass over it without sticking to the bitumen. Brooms shall be used in spreading this first coating of pea stone. The surface shall then be thoroughly rolled, and after rolling, the surplus pea stone and dust shall be completely removed by sweeping.

A second application of bitumen shall then be made in the same manner as in the first application, so as to completely coat the surface, and shall be at the rate of one-half ( $\frac{1}{2}$ ) gallon per square yard. After the second application of bitumen has been made, it shall be uniformly covered with a sufficient coating of pea stone, as directed by the Engineer, and then thoroughly rolled.

If so ordered by the Engineer the rate of application of bituminous material per square yard shall be increased or diminished at such places as he may direct.

The bituminous material when applied to the upper course of stone shall have a temperature approximating 300° F. for asphalt and 200° F. for tar.

Any depressions or irregularities appearing after the final rolling shall be neatly patched in such a manner as shall be directed by the Engineer, so that the final surface shall be perfectly uniform and true to the specified cross-section and grade.

If at any time before the acceptance of the work any soft or imperfect places or spots shall develop in the surface, all such places shall be removed and replaced with new material and then rolled until thoroughly compacted, and until the joints or edges at which the new work connects with the old become invisible. All such removal and replacing of unsatisfactory surfacing shall be done at the expense of the Contractor.

No bituminous work shall be done during rainy weather nor when weather conditions as to temperature or otherwise, are, in the opinion of the Engineer, unsatisfactory for obtaining good results.

The stone shall be perfectly dry before applying the bituminous material, and shall be weighed as provided for under Section 31.

The Contractor shall not allow the bituminous material to be overheated or burnt.

**Section 36. BASIS OF PAYMENT.** This work shall be paid for as follows:

The broken stone shall be paid for at the contract unit price per ton rolled, complete in place.

The bituminous material shall be paid for at the contract unit price per gallon heated and applied, complete in place.

The above prices shall include all materials, equipment, tools, labor and work incidental thereto.

### Bituminous Concrete Surfacing.

#### TYPE A.

**Section 37. DESCRIPTION.** The bituminous concrete surfacing shall consist of sand and stone screenings mixed with bituminous material. The seal coat consists of a final superficial application of bituminous material covered with sand to the bituminous concrete surfacing.

The bituminous concrete surfacing shall be placed upon the sub-grade or upon the sub-base as directed by the Engineer and in accordance with these specifications.

The width and the depth (after rolling) shall be as shown on the plans.

**Section 38. MATERIALS.** The mineral aggregate shall consist of thirty (30) per cent broken stone screenings and seventy (70) per cent sand.

The stone screenings shall consist of sound, durable rock having a French coefficient of wear of not less than 10 and a toughness not less than 8.

The sand and stone shall contain no particles of shale, slate or other materials which easily disintegrate, and shall be free from loam, vegetable or other adventitious matter.

The stone screenings and sand when tested by means of laboratory screens shall meet respectively the following requirements:

#### Stone Screenings.

Passing $\frac{1}{2}$ " screen.....	100%
Passing $\frac{1}{2}$ " screen retained on $\frac{1}{4}$ " screen.....	5 to 20%
Passing $\frac{1}{4}$ " screen retained on No. 10 screen.....	20 to 50%
Passing No. 10 screen retained on No. 30 screen.....	20 to 50%
Passing No. 30 screen retained on No. 100 screen.....	10 to 35%
Passing No. 100 screen.....	0 to 15%

#### Sand.

Passing $\frac{3}{4}$ " screen.....	100%
Passing $\frac{3}{4}$ " screen retained on $\frac{1}{4}$ " screen.....	0 to 15%
Passing $\frac{1}{4}$ " screen retained on No. 10 screen.....	0 to 15%
Passing No. 10 screen retained on No. 30 screen.....	20 to 75%
Passing No. 30 screen retained on No. 100 screen.....	5 to 35%
Passing No. 100 screen.....	0 to 15%

The bituminous material for the bituminous concrete shall consist of oil asphalt, shall form from 5.5 to 6.5% of the mass by weight and shall have the following properties:

Oil asphalt shall be homogeneous, free from water, and shall not foam when heated to 175° C. (347° F.)

It shall meet the following requirements:

1. Specific gravity 25°/25° C. (77°/77° F.).....	not less than 1.010
2. Flash point.....	not less than 175° C. (347° F.)
3. Melting point.....	40° C. (104° F.) to 60° C. (140° F.)
4. Penetration at 25° C. (77° F.), 100 g., 5 sec.....	60 to 70
5. Loss at 163° C. (325° F.), 5 hours.....	not more than 1.0%
a. Penetration of residue at 25° C. (77° F.) 100 g., 5 sec.....	not less than 40
6. Total bitumen (soluble in carbon disulphide).....	not less than 99.5%
a. Organic matter insoluble.....	not more than 0.2%

**NOTE.**—Material for any one contract shall not vary more than 0.020 in specific gravity nor more than 10° C. in melting point within the test limits above specified.

The bituminous material for the seal coat shall have the following properties:

1. Specific gravity 25°/25° C. (77°/77° F.).....	not less than 0.98
2. Flash point.....	not less than 94° C. (201° F.)
3. Loss at 163° C. (325° F.), 5 hours.....	not more than 10%
4. Total bitumen (soluble in carbon disulphide).....	not less than 99.5%
5. Total bitumen insoluble in 86° B naphtha.....	not less than 15.0%
6. The asphaltic content at 100 penetration shall be not less than 85%.	

**Section 39. CONSTRUCTION METHODS.** When the sand and stone for the bituminous concrete surfacing has been heated to not less than 180° F. nor more than 250° F., it shall be mixed with the asphalt by machines, which shall be approved by the Engineer, and as the Engineer may direct until all particles of sand and stone are covered with asphalt.

Before mixing with the sand and stone the asphalt shall be carefully heated to not less than 200° F. and not more than 375° F.

The Contractor shall not allow the asphalt to be heated above 375° F. and all asphalt that is heated over 375° F. shall be rejected and removed from the work.

After being satisfactorily prepared as hereinbefore specified, the bituminous concrete shall be teamed to the road and spread before it has cooled to the temperature below 100° F. or to such higher temperature as may be considered necessary by the Engineer.

The bituminous concrete shall be laid in two courses. The first course shall be       inches and the second course shall be       inches in depth after rolling.

The bituminous concrete shall be dumped on a steel dumping platform, or shoveled directly from the cart into place.

The edges of the bituminous concrete, as it is laid, shall be spread against spruce planks laid true to line and grade and so secured that they will not become displaced when the mixture is being spread and rolled.

As the spreading is done, rakes shall be used to obtain a uniform distribution of the sand and stone, and to remove from the top surface the larger stones and to obtain an even surface before rolling.

The bituminous concrete after being satisfactorily spread and raked shall be at once rolled with a tandem roller weighing not less than six (6) tons, care being taken not to push the mixture out of place by the roller but to roll so as to lay it down, compressed to the proper cross-section and true to line and grade.

The rolling shall be first longitudinal, second diagonal both ways and third cross rolling, all to be when and as directed by the Engineer and such additional rolling in any direction as the Engineer may direct.

Rolling shall be continued until the surface is true and even. If, through imperfect spreading or rolling or for any other reason irregularities develop in the shape of the surface so that there are projections or depressions which cannot be rolled out, the bituminous concrete shall be removed at such places and replaced with new bituminous concrete spread and rolled as hereinbefore specified until the surface is true and even and satisfactory to the Engineer. All labor incurred and materials used in the above replacement, including all incidental work, shall be at the expense of the Contractor and without additional compensation.

When necessary in the opinion of the Engineer, the rolling shall be postponed until cool enough to roll without pushing out of place and shape.

After the bituminous concrete is rolled to a firm surface, free from all irregularities and all surplus loose material, a seal coat of asphaltic oil shall be distributed at the rate of one-quarter ( $\frac{1}{4}$ ) of a gallon per square yard of road surface. This application of oil so applied shall be uniformly covered with a sufficient layer of sand and rolled to the satisfaction of the Engineer.

The asphaltic oil, when applied to the road surface, shall have a temperature approximating 350° F.

If so ordered by the Engineer the thickness of the bituminous concrete shall be increased or diminished at such points as he may direct.

The sand used to cover the seal coat shall be satisfactory to the Engineer.

If at any time before the acceptance of the work, any soft or imperfect places or spots shall develop in the surface, all such places shall be removed and replaced with new material and then rolled until the edges at which the new work connects with the old become invisible. All such removal and replacement of unsatisfactory surfacing shall be done at the expense of the Contractor.

No teaming or travel of any kind shall be allowed to pass over the new surface until twenty-four hours have elapsed after the final rolling or until the surface has become sufficiently hardened to prevent injury by picking up or tracking.

No bituminous work shall be done during rainy weather, nor when weather conditions as to temperature or otherwise are, in the opinion of the Engineer, unsuitable for obtaining good results.

Scales for weighing the concrete shall be furnished, set and sealed at the expense of the Contractor. A sworn weigher will be furnished and paid by the Department.

**Section 40. BASIS OF PAYMENT.** This work shall be paid for at the contract unit price per ton for "Bituminous Concrete Surfacing Type A," complete in place (except seal coat).

The seal coat shall be paid for at the contract unit price per gallon of bituminous material, furnished and applied, including sand covering.

The above prices shall include all materials, equipment, tools, labor and work incidental thereto.

### Bituminous Concrete Surfacing.

#### TYPE B.

**Section 41. DESCRIPTION.** The bituminous concrete surfacing shall consist of sand and stone mixed with bituminous material. The seal coat consists of a final superficial application of bituminous material covered with sand to the bituminous concrete surfacing.

The bituminous concrete surfacing shall be placed upon the sub-grade or upon the sub-base as directed by the Engineer and in accordance with these specifications.

The width and the depth (after rolling) shall be as shown on the plans.

**Section 42.** The mineral aggregate shall consist of stone and sand and shall contain no particles of shale, slate or other materials which easily disintegrate, and shall be free from loam, vegetable or other adventitious matter.

The stone and sand when tested by means of laboratory screens shall meet the following requirements:

Passing $\frac{3}{4}$ " screen.....	100%
Passing $\frac{3}{4}$ " screen retained on $\frac{1}{4}$ " screen.....	0 to 15%
Passing $\frac{1}{4}$ " screen retained on No. 10 screen.....	0 to 15%
Passing No. 10 screen retained on No. 30 screen.....	20 to 75%
Passing No. 30 screen retained on No. 100 screen.....	5 to 35%
Passing No. 100 screen.....	0 to 15%

The bituminous material for the bituminous concrete shall consist of oil asphalt, shall form from 5.0 to 6.0% of the mass by weight and shall have the following properties:

Oil asphalt shall be homogeneous, free from water, and shall not foam when heated to 175° C. (347° F.).

It shall meet the following requirements:

1. Specific gravity 25°/25° C. (77°/77° F.) .....	not less than 1.010
2. Flash point.....	not less than 175° C. (347° F.)
3. Melting point.....	40° C. (104° F.) to 60° C. (140° F.)
4. Penetration at 25° C. (77° F.), 100 g., 5 sec.....	60 to 70
5. Loss at 163° C. (325° F.), 5 hours.....	not more than 1.0%
a. Penetration of residue at 25° C. (77° F.), 100 g., 5 sec.....	not less than 40
6. Total bitumen (soluble in carbon disulphide).....	not less than 99.5%
a. Organic matter insoluble.....	not more than 0.2%

**NOTE.**— Material for any one contract shall not vary more than 0.020 in specific gravity nor more than 10° C. in melting point within the test limits above specified.

The bituminous material for the seal coat shall have the following properties:

1. Specific gravity 25°/25° C. (77°/77° F.) ..... not less than 0.98
2. Flash point ..... not less than 94° C. (201° F.)
3. Loss at 163° C. (325° F.) 5 hours ..... not more than 10%
4. Total bitumen (soluble in carbon disulphide) ..... not less than 99.5%
5. Total bitumen insoluble in 86° B naphtha ..... not less than 15.0%
6. The asphaltic content at 100 penetration shall be not less than 85%.

**Section 43. CONSTRUCTION METHODS.** When the sand and stone for the bituminous concrete surfacing has been heated to not less than 180° F. nor more than 250° F., it shall be mixed with the asphalt by machines, which shall be approved by the Engineer, and as the Engineer may direct until all particles of sand and stone are covered with asphalt.

Before mixing with the sand and stone the asphalt shall be carefully heated to not less than 200° F. and not more than 375° F.

After being satisfactorily prepared as hereinbefore specified, the bituminous concrete shall be teamed to the road and spread before it has cooled to the temperature below 100° F. or to such higher temperature as may be considered necessary by the Engineer.

The bituminous concrete shall be laid in two courses. The first course shall be inches and the second course shall be inches in depth after rolling.

The bituminous concrete shall be dumped on steel dumping platform, or shoveled directly from the cart into place.

The bituminous concrete shall be dumped on steel dumping platform, or shoveled directly from the cart into place. The edges of the bituminous concrete, as it is laid, shall be spread against spruce planks laid true to line and grade and so secured that they will not become displaced when the mixture is being spread and rolled.

As the spreading is done, rakes shall be used to obtain a uniform distribution of the sand and stone, and to remove from the top surface the larger stones and to obtain an even surface before rolling.

The bituminous concrete after being satisfactorily spread and raked, shall be at once rolled with a tandem roller weighing not less than six (6) tons, care being taken not to push the mixture out of place by the roller but to roll so as to lay it down, compressed to the proper cross-section and true to line and grade.

The rolling shall be first longitudinal, second diagonal both ways and third cross rolling, all to be when and as directed by the Engineer and such additional rolling in any direction as the Engineer may direct.

Rolling shall be continued until the surface is true and even. If, through imperfect spreading or rolling or for any other reason irregularities develop in the shape of the surface so that there are projections or depressions which cannot be rolled out, the bituminous concrete shall be removed at such places and replaced with new bituminous concrete spread and rolled as herein-before specified until the surface is true and even and satisfactory to the Engineer. All labor incurred and materials used in the above replacement, including all incidental work, shall be at the expense of the Contractor and without additional compensation.

When necessary in the opinion of the Engineer, the rolling shall be postponed until cool enough to roll without pushing out of place and shape.

After the bituminous concrete is rolled to a firm surface, free from all irregularities and all surplus loose material, a seal coat of asphaltic oil shall be distributed at the rate of one-quarter ( $\frac{1}{4}$ ) of a gallon per square yard of road surface. This application of oil so applied shall be uniformly covered with a sufficient layer of sand and rolled to the satisfaction of the Engineer.

The asphaltic oil, when applied to the road surface, shall have a temperature approximating 350° F.

If so ordered by the Engineer the thickness of the bituminous concrete shall be increased or diminished at such points as he may direct.

The sand used to cover the seal coat shall be satisfactory to the Engineer.  
If at any time before the acceptance of the work, any soft or imperfect places or spots shall develop in the surface, all such places shall be removed and replaced with new material and then rolled until the edges at which the new work connects with the old become invisible. All such removal and replacement of unsatisfactory surfacing shall be done at the expense of the Contractor.

No teaming or travel of any kind shall be allowed to pass over the new surface until twenty-four hours have elapsed after the final rolling or until the surface has become sufficiently hardened to prevent injury by picking up or tracking.

No bituminous work shall be done during rainy weather, nor when weather conditions as to temperature or otherwise are, in the opinion of the Engineer, unsuitable for obtaining good results.

Scales for weighing the concrete shall be furnished, set and sealed at the expense of the Contractor. A sworn weigher will be furnished and paid by the Department.

**Section 44. BASIS OF PAYMENT.** This work shall be paid for at the contract unit price per ton for "Bituminous Concrete Surfacing Type B," complete in place (except seal coat).

The seal coat shall be paid for at the contract unit price per gallon of bituminous material, furnished and applied, including sand covering.

The above prices shall include all materials, equipment, tools, labor and work incidental thereto.

## Bituminous Concrete Surfacing.

TYPE C.

**Section 45. DESCRIPTION.** The bituminous concrete surfacing shall consist of broken stone or crushed and screened gravel stone, sand or stone screenings, mixed with bituminous material.

The bituminous concrete surfacing shall be placed on a broken stone base course or upon a crushed and screened gravel stone base course as directed by the Engineer and in accordance with these specifications.

The width and the depth (after rolling) shall be as shown on the plans.

**Section 46. MATERIALS.** The sand and stone shall consist of sound, hard, durable rock of high resistance to abrasion and shall contain no particles of shale, slate or other materials which easily disintegrate. It shall be free from loam, vegetable or other adventitious matter.

The stone shall have a French coefficient of wear not less than 10 and a toughness not less than 8.

The stone and sand when tested by means of laboratory screens shall meet the following requirements:	
Passing $\frac{3}{4}$ inch screen.....	100%
Passing $\frac{1}{2}$ inch screen retained on $\frac{1}{4}$ inch screen.....	8 to 30%
Passing $\frac{1}{4}$ inch screen retained on No. 10 screen.....	15 to 36%
Passing No. 10 screen retained on No. 40 screen.....	20 to 39%
Passing No. 40 screen retained on No. 80 screen.....	4 to 14%
Passing No. 80 screen retained on No. 200 screen.....	5 to 9%
Passing No. 200 screen.....	1 to 5%

The bituminous material shall consist of oil asphalt, shall form from 6.5 to 8% of the mass by weight and shall have the following properties:

Oil asphalt shall be homogeneous, free from water, and shall not foam when heated to 175° C. (347° F.).

It shall meet the following requirements:

1. Specific gravity 25°/25° C. (77°/77° F.) .....	not less than 1.010
2. Flash point.....	not less than 175° C. (347° F.)
3. Melting point.....	40° C. (104° F.) to 60° C. (140° F.)
4. Penetration at 25° C. (77° F.), 100 g., 5 sec.....	60 to 70
5. Loss at 163° C. (325° F.), 5 hours.....	not more than 1.0%
a. Penetration of residue at 25° C. (77° F.), 100 g., 5 sec.....	not less than 40
6. Total bitumen (soluble in carbon disulphide).....	not less than 99.5%
a. Organic matter insoluble.....	not more than 0.2%

NOTE.— Material for any one contract shall not vary more than 0.020 in specific gravity nor more than 10° C. in melting point within the test limits above specified.

**Section 47. CONSTRUCTION METHODS.** When the sand and stone for the bituminous concrete surfacing has been heated to not less than 180° F. nor more than 250° F., it shall be mixed with the asphalt by machines, which shall be approved by the Engineer, and as the Engineer may direct until all particles of sand and stone are covered with asphalt.

Before mixing with the sand and stone the asphalt shall be carefully heated to not less than 200° F. and not more than 375° F.

The Contractor shall not allow the asphalt to be heated above 375° F. and all asphalt that is heated over 375° F. shall be rejected and removed from the work.

After being satisfactorily prepared as hereinbefore specified, the bituminous concrete shall be teamed to the road and spread before it has cooled to the temperature below 100° F. or to such higher temperature as may be considered necessary by the Engineer.

The bituminous concrete shall be dumped on steel dumping platform, or shoveled directly from the cart into place.

The edges of the bituminous concrete, as it is laid, shall be spread against spruce planks laid true to line and grade and so secured that they will not become displaced when the mixture is being spread and rolled.

As the spreading is done, rakes shall be used to obtain a uniform distribution of the sand and stone, and to remove from the top surface the larger stones and to obtain an even surface before rolling.

The bituminous concrete after being satisfactorily spread and raked, shall be at once rolled with a tandem roller weighing not less than six (6) tons, care being taken not to push the mixture out of place by the roller but to roll so as to lay it down, compressed to the proper cross-section and true to line and grade.

The rolling shall be first longitudinal, second diagonal both ways and third cross rolling, all to be when and as directed by the Engineer and such additional rolling in any direction as the Engineer may direct.

Rolling shall be continued until the surface is true and even. If, through imperfect spreading or rolling or for any other reason irregularities develop in the shape of the surface so that there are projections or depressions which cannot be rolled out, the bituminous concrete shall be removed at such places and replaced with new bituminous concrete spread and rolled as hereinbefore specified until the surface is true and even and satisfactory to the Engineer. All labor incurred and materials used in the above replacement, including all incidental work, shall be at the expense of the Contractor and without additional compensation.

When necessary in the opinion of the Engineer, the rolling shall be postponed until cool enough to roll without pushing out of place and shape.

If so ordered by the Engineer the thickness of the bituminous concrete shall be increased or diminished at such points as he may direct.

If at any time before the acceptance of the work, any soft or imperfect places or spots shall develop in the surface, all such places shall be removed and replaced with new material and then rolled until the edges at which the new work connects with the old become invisible. All such removal and replacement of unsatisfactory surfacing shall be done at the expense of the Contractor.

No teaming or travel of any kind shall be allowed to pass over the new surface until twenty-four hours have elapsed after the final rolling or until the surface has become sufficiently hardened to prevent injury by picking up or tracking.

No bituminous work shall be done during rainy weather, nor when weather conditions as to temperature or otherwise are, in the opinion of the Engineer, unsuitable for obtaining good results.

Scales for weighing the concrete shall be furnished, set and sealed at the expense of the Contractor. A sworn weigher will be furnished and paid by the Department.

**Section 48. BASIS OF PAYMENT.** This work shall be paid for at the contract unit price per ton for "Bituminous Concrete Surfacing Type C," complete in place, which price shall include all materials, equipment, tools, labor and work incidental thereto.

#### Bituminous Concrete Surfacing.

##### TYPE D.

**Section 49. DESCRIPTION.** The bituminous concrete surfacing shall consist of broken stone, sand or stone screenings, and a mineral filler, mixed with asphalt.

The bituminous concrete surfacing shall be placed on a base course (prepared as hereinbefore specified), and in accordance with these specifications.

The width of the surfacing shall be as shown on the plans and the depth shall be two (2) inches after rolling.

**Section 50. MATERIALS.** Stone shall have a French coefficient of wear not less than 10 and a toughness not less than 8. Stone when tested by means of laboratory screens and sieves shall conform to the following requirements:

Passing		100%
1 $\frac{1}{4}$ " screen		
$\frac{3}{4}$ " screen		95 to 100%
$\frac{1}{2}$ " screen		25 to 75%
$\frac{1}{4}$ " screen		0 to 25%
10 mesh sieve		0 to 5%

Pea stone shall consist of that portion of the crusher product which will pass a three-quarter ( $\frac{3}{4}$ ) inch screen and will be retained on a quarter inch screen and shall be free from dust.

Sand shall consist of grains or particles of quartz or other hard and durable rocks, the surfaces of which are not coated with any foreign material nor worn smooth. The grains shall be moderately sharp, free from soft, decomposed or partly decomposed sand grains, lumps of clay, or ferruginous cemented sand, mica, loam, sea salts, organic matter, or other foreign materials.

Sand when tested by means of laboratory screens and sieves shall conform to the following requirements:

PASSING —	Retained on —	Per Cent.
$\frac{1}{4}$ " screen	10 mesh sieve	0 to 2
10 mesh sieve	30 mesh sieve	10 to 30
30 mesh sieve	50 mesh sieve	15 to 42
50 mesh sieve	80 mesh sieve	20 to 35
80 mesh sieve	200 mesh sieve	15 to 35
200 mesh sieve		5

Mineral filler shall be Portland cement, ground limestone or pulverized lime, not less than eighty-five (85) per cent of which must pass a one hundred (100) mesh sieve and sixty-five (65) per cent a two hundred (200) mesh sieve. It shall be free from lumps or balls, or any foreign material that may injure it for the purpose intended.

Bituminous material shall consist of asphalt and shall have the following properties:

Oil asphalt shall be homogeneous, free from water, and shall not foam when heated to 175° C. (347° F.).

It shall meet the following requirements:

1. Specific gravity 25°/25° C. (77°/77° F.)	not less than 1.020
2. Flash point	not less than 175° C. (347° F.)
3. Melting point	40° C. (104° F.) to 60° C. (140° F.)
4. Penetration at 25° C. (77° F.), 100 g., 5 sec.	50 to 60
5. Loss at 163° C. (325° F.), 5 hours	not more than 1.0%
a. Penetration of residue at 25° C. (77° F.), 100 g., 5 sec.	not less than 30
6. Total bitumen (soluble in carbon disulphide)	not less than 99.5%
a. Organic matter insoluble	not more than 0.2%

Fluxed native lake asphalt shall be homogeneous, free from water, and shall not foam when heated to 175° C. (347° F.).

It shall meet the following requirements:

1. Specific gravity 25°/25° C. (77°/77° F.)	1.050 to 1.070
2. Flash point	not less than 175° C. (347° F.)
3. Melting point	45° C. (113° F.) to 55° C. (131° F.)
4. Penetration at 25° C. (77° F.), 100 g., 5 sec.	50 to 60
5. Loss at 163° C. (325° F.), 5 hours	not more than 3.0%
a. Penetration of residue at 25° C. (77° F.), 100 g., 5 sec.	not less than 25
6. Total bitumen (soluble in carbon disulphide)	not less than 94.0%
a. Inorganic matter insoluble	2.5% to 4.0%

The finished pavement, exclusive of any bituminous sealing mixture applied, shall not vary in composition more than the limits given below:

SCREENS AND SIEVES.		Type of Openings.	Minimum.	Maximum.
Passing —	Retained on —			
1"	$\frac{1}{2}$ "	Circular	0.0%	15.0%
$\frac{1}{2}$ "	$\frac{1}{4}$ "	Circular	20.0%	45.0%
$\frac{1}{4}$ "	10 mesh	Circular	10.0%	25.0%
10 mesh	30 mesh	Square	4.0%	12.0%
30 mesh	50 mesh	Square	6.0%	12.0%
50 mesh	80 mesh	Square	6.0%	12.0%
80 mesh	200 mesh	Square	5.0%	11.0%
200 mesh		Square	5.0%	8.0%
Total Stone Content Retained on 10 mesh Sieve			50.0%	70.0%
Bitumen Content			6.5%	8.0%

The proportions of the different ingredients required to prepare the pavement shall be determined by weight. The pavement must not vary in composition more than the specified limits given.

The bitumen content is based upon the finished pavement, exclusive of any mineral or bituminous surface coating applied. The exact amount of mineral filler and asphalt to use between the limits defined herein shall be determined by the Testing Engineer. In calculating the percentages of the various sizes of ingredients of which the mineral aggregate is composed, the bitumen is included.

**Section 51. CONSTRUCTION METHODS.** The quantity of ingredients used per batch in the preparation of the paving mixture must be accurately determined by either weight or measurement, depending upon the type of plant and kind of material being used. In either case the devices used in measuring these ingredients must be standardized whenever so requested, also the manner in which these devices are used shall be demonstrated and the quantity of material thus secured verified, whenever so ordered by the Engineer. The plant used in preparing the paving mixture shall comply with the requirements given below.

The mineral filler shall be so cast into the mixing chamber that it is evenly distributed over the surface of the aggregate and not dumped in one end of the mixing chamber. The asphalt shall be added slowly in a thin sheet the full width of the mixing chamber. The time required to produce a uniform paving mixture shall be from one (1) to one and one-half ( $1\frac{1}{2}$ ) minutes.

The aggregate must have a temperature of not less than 275° F. nor more than 350° F. when ready to be coated with the asphalt. The asphalt when applied to the aggregate must have a temperature of not less than 250° F. and must be free from unmelted lumps. The mineral filler may be added cold, but must be thoroughly dry.

In the preparation of this mixture the stone and sand are first added to the mixing chamber, then the mineral filler. After the mineral filler has become uniformly distributed through the aggregate the asphalt shall be added and the mixing continued until a bituminous mixture is secured that is uniform and homogeneous in composition and all the particles of the aggregate are uniformly and completely coated with the hot asphalt.

The paving mixture must be kept clean during hauling and handling and covered during transit with canvas or other materials which will retain its temperature. The mixture must not be hauled such a distance that segregation of the ingredients takes place or that a crust is formed on the surface, bottom or sides of said mixture which has a temperature lower than that required. These mixtures must not be dumped any faster than they can be properly handled by the shovelers. They must be spread immediately after being dumped and must be kept perfectly clean until spread. Any part of the paving mixture which becomes dirty or chilled below the required temperature must be rejected. All paving mixture must be carefully removed from the spot upon which it was placed before any additional paving mixture is placed thereon.

The paving mixture when dumped on the platforms or base course must have a temperature between 275° F. and 350° F. Any portion of the paving mixture that becomes chilled below 250° F. before being spread shall be discarded.

The paving mixture may be dumped on a concrete base course, but when the base course is of other types, it shall be dumped on metal or wooden platforms which must be of such size that the paving mixture will not fall off when dumped thereon or work off during spreading. Each load of paving mixture must be dumped outside of the area over which it will be spread.

All vehicles used in transporting paving mixtures must have tight-fitting bottoms which will hold hot, thin mixtures without leaking. When motor trucks are used the bodies should be insulated for long hauls during cold weather so that the paving mixtures adjacent the ends and sides will not become chilled during transit. All motor trucks used for this purpose must have dump bodies that will permit the rapid unloading of the mixture. The inside surface of these bodies should be oiled just before loading. However, only sufficient oil shall be used to coat the surface. No pools of oil must appear in the bottom of the truck.

Immediately after the paving mixture has been dumped upon the platform, it shall be deposited at once upon the base course with hot shovels in such a manner that any segregation of the ingredients or irregularities in composition will be eliminated as much as possible. After being thus deposited it shall be so spread with hot iron rakes that after being thoroughly compacted by tamping and rolling it shall have the average thickness, surface finish and contour specified.

During spreading and raking the workmen must not walk over or stand on the paving mixture except when necessary to correct irregularities in the initial raking. The paving mixture shall not be spread any faster than it can be properly handled by the rakers.

Special care shall be used in spreading and raking the wearing surface so that porous spots, depressions or projections shall be eliminated. For this purpose the Contractor shall employ not less than three (3) rakers for each one hundred (100) square yards of surface pavement laid per hour. Additional rakers must be employed when a greater quantity of pavement is being laid per hour.

The rolling of the paving mixture must be so executed that porous spots will be eliminated, the formation of waves and depressions prevented and the required density and surface finish secured.

Whenever the pavement is laid alongside of gutters, street car tracks, manhole heads, the finished surface adjacent to them shall be left one-quarter ( $\frac{1}{4}$ ) of an inch high in order to provide for subsequent compression by traffic and to avoid depressions which would otherwise be liable to occur at these points.

After the paving mixture has been properly spread and raked it shall be rolled as soon as it will bear the roller without undue displacement or hair cracking. Delays in the initial rolling of the freshly raked mixtures will not be permitted. In all places inaccessible to a roller, such as adjacent to curbs, gutters, headers, manholes, etc., the required compression shall be secured with hot tampers.

The initial rolling of the paving mixture may be done with a five (5) to eight (8) ton tandem roller, but final compression shall always be secured with a ten (10) to twelve (12) ton three-wheel power roller.

When more than one hundred (100) square yards of wearing surface are being laid per hour, two (2) rollers shall be kept in use, one of which shall be of the finishing size. An additional finishing roller will be required for each additional one hundred (100) square yards of wearing surface laid per hour. All rollers used shall be kept in good condition and shall weigh not less than two hundred (200) pounds to the inch width of tread. Each roller shall be in the charge of a competent experienced roller engineer and must be kept in continuous operation as nearly as practicable. During an eight-hour day each roller must be engaged in actual rolling for not less than six and one-half ( $6\frac{1}{2}$ ) hours, not more than one and one-half ( $1\frac{1}{2}$ ) hours being allowed for cleaning fires, watering, etc. The ashes from the roller must not be dumped upon the base course or wearing surface.

The surface of the wheels of the roller must be kept clean at all times and either oiled or wet with water as ordered by the Engineer. When the use of water is permitted, it shall not be applied in such quantity that surplus water will run off of the wheels of the roller onto the pavement.

During the initial rolling, the roller shall travel parallel to the axis of the pavement, beginning at each edge and working towards the center. Each trip of the roller shall overlap the preceding one about one-half ( $\frac{1}{2}$ ) the width of the roller. Alternate trips of the roller should be of slightly different lengths. Subsequent rolling shall be both diagonal and parallel to the axis of the pavement. The rolling shall be continued at the rate of not more than one hundred fifty (150) square yards of wearing surface per hour for each roller of the finishing size. The roller must not pass off the pavement during rolling, nor stand on the completed pavement which has not cooled to normal temperature.

The rolling shall be so executed that all parts of the pavement will receive equal compression; also develop any low or high spots caused by improper spreading and raking. The surface of low spots or depressions shall be roughened with a hot rake, additional material added thereto and rereeled immediately. Excess material shall be removed from the high spots. Such repairs should be made as soon after the initial rolling as possible while the pavement is yet fairly soft.

As soon as possible after the rolling of the mixture is finished and while the surface is yet fresh, clean and hot, a seal coat of asphalt shall be spread thereon. The asphalt used for this purpose shall be the same as used in preparing the pavement mixture. It shall be applied at a temperature between 250° F. and 350° F. from a squeegee distributor, and then evenly spread with rubber squeegees. Only sufficient asphalt shall be used to coat the surface and fill the surface voids without leaving an excess on the surface. Immediately over this a top dressing of pea stone shall be uniformly spread and rolled into the surface. Some surplus of this dressing shall be left on the surface.

The surface of the finished pavement must conform to the grade and contour specified and shall be free from depressions or projections. It must be uniform in density and composition, thoroughly bonded together and water tight, and be free from porous spots that will remain wet after the balance of the surface is dry. Such portions of the completed pavement as are defective

in finish, or that do not comply in all respects with the requirements of these specifications, shall be taken up, removed and replaced with suitable material, properly made and laid in accordance with the requirements of these specifications at the expense of the Contractor.

The paving shall be so done that the number of joints required shall be reduced to a minimum. At all joints the edges of the previously laid pavement shall be cut off in a straight line far enough back from the edge to insure that the wearing surface has the required thickness. The cut shall be made at a slight angle to the pavement surface and present a smooth unbroken edge. The face of the joint shall be painted with bituminous cement, after which the hot bituminous mixture shall be raked over it to the proper depth. Hot smoothers or tampers shall be carefully employed in such a manner as to insure the proper bond between the two (2) paving mixtures without burning or injuring either. The finished joint must be on the same plane as the adjacent finished pavement surface. Joints which are above or below the general plane of the pavement surface must be brought to the proper grade or remade.

The faces of all curbs and gutters, iron castings or other objects projecting through the pavement shall be painted with hot bituminous cement before the adjoining paving mixture is laid. The adjacent paving mixture shall be compressed by ramming with hot iron tampers when the required compression cannot be secured with the roller.

The base course, when a bituminous pavement is applied thereon, must be dry, clean and free from all frost. It must conform to the grade and crown specified, and comply with the requirements given for the type of base course being used. When a base course is in the proper condition to receive a paving mixture it must be protected from all travel that will injure, deface or carry foreign material upon it.

When the edges of pavements are not protected by a concrete or stone curb or header, four (4) to six (6) inch planks of the same thickness as the finished pavement must be used for this purpose, which shall be firmly secured and left in place until the pavement has been properly rolled and thoroughly set.

No teaming or travel of any kind shall be allowed to pass over the new pavement until twenty-four hours have elapsed after the final rolling or until the pavement has become sufficiently hardened to prevent injury by picking up or tracking.

No bituminous work shall be done during rainy weather nor when weather conditions as to temperature or otherwise are, in the opinion of the Engineer, unsuitable for obtaining good results.

The workmen employed by the Contractor must have had sufficient experience in the preparation of bituminous paving mixtures and the construction of bituminous pavements to be able to operate the equipment in such a manner that the pavement produced will have the required composition, density and surface finish. The men operating the mixing plant, the spreaders, rakers and roller men must show by the work completed that they have had the necessary experience and are making the proper effort to execute the work in the manner required by these specifications. Otherwise, their services will have to be dispensed with by the Contractor.

For the determination of the temperatures and quantities of materials used throughout the process of manufacture, the Contractor shall provide and maintain at the plant suitable thermometers, an automatic recording thermometer for each asphalt tank in use, not less than two platform scales, and such other weighing apparatus as is required by the specifications. The Contractor shall also provide and maintain at the plant, blank charts for the recording thermometers. These charts shall be renewed on the recording dials daily.

The plant used in preparing all bituminous paving mixtures must be of the batch type, capable of mixing in the manner herein specified, and must be provided with separate chambers for heating and mixing the ingredients. No direct heat except steam shall be applied to the exterior surface of the mixing chamber, no flame shall be allowed to pass through the mixing chamber. The heat must be so regulated that the stone and sand can easily be heated to and maintained at the required temperature.

Scales for weighing the concrete shall be furnished, set and sealed at the expense of the Contractor. A sworn weigher will be furnished and paid by the Department.

**Section 52. BASIS OF PAYMENT.** This work shall be paid for at the contract unit price per ton for "Bituminous Concrete Surfacing Type D," complete in place, which price shall include all materials, equipment, tools, labor and work incidental thereto.

#### Reinforced Cement Concrete Surfacing.

**Section 53. DESCRIPTION.** This surfacing shall consist of concrete composed by volume of one (1) part of Portland cement, eight hundredths (8/100) of a part of hydrated lime, two (2) parts of fine aggregate, four (4) parts of coarse aggregate, and steel reinforcement, constructed on the prepared sub-grade, in one course, and in accordance with these specifications.

The width and the depth (after finishing) shall be as shown on the plans.

**Section 54. MATERIALS.** (a) *Cement.* The cement shall meet the requirements of the standard specifications and tests for Portland cement, adopted by the American Society for Testing Materials, January 1, 1921, with all subsequent amendments and additions thereto adopted by said Society.

(b) *Hydrated Lime.* The hydrated lime shall meet the requirements of the standard specifications and tests for hydrated lime adopted by the American Society for Testing Materials.

(c) *Water.* The water used shall be free from oil, acid, alkali or organic matter and neither brackish nor salt.

(d) *Fine Aggregate.* The fine aggregate shall consist of sand or a combination of sand and stone screenings, conforming to the following requirements:

*Sand.* The sand shall consist of grains or particles of quartz or other hard and durable rocks, the surfaces of which are not coated with any foreign material nor worn smooth. The grains shall be moderately sharp, free from soft, decomposed or partly decomposed sand grains, lumps of clay, or ferruginous cemented sand, mica, loam, sea salts, organic matter or other foreign materials.

The sand shall be well graded from coarse to fine and when tested by means of laboratory screens and sieves shall meet the following requirements:

	Per Cent.
Passing $\frac{1}{4}$ inch screen.....	100
Passing 20 mesh sieve.....	30 to 75
Passing 50 mesh sieve not more than.....	28
Passing 100 mesh sieve not more than.....	4
By elutriation test not more than.....	3

*Stone Screenings.* The stone screenings shall be clean and dustless and shall consist of material resulting from the crushing of clean, tough, durable rock having a French coefficient of wear of not less than eight (8) and prepared by screening through a revolving screen having circular openings not larger than three-eighths ( $\frac{3}{8}$ ) of an inch in diameter and from which the dust of fracture has been removed by a process of screening or blowing. Stone screenings shall be used only in combination with sand, each measured separately and accurately by volume, the proportion being twenty-five (25) per cent by weight of the total fine aggregate.

*Combinations of Sand and Stone Screenings.* Combinations of sand and stone screenings shall contain not more than twenty-five (25) per cent, by weight of particles passing a Standard No. 50 laboratory sieve and not more than seven (7) per cent by weight passing a No. 100 sieve.

When the fine aggregate is mixed with Portland cement in the proportion of one part of cement to three parts of sand by weight, the resulting mortar at the age of seven and twenty-eight days shall have a tensile and compressive strength of at least one hundred (100) per cent of that developed in the same time by mortar of the same proportions and consistency, made of the same cement and standard Ottawa sand.

(e) *Coarse Aggregate.* The coarse aggregate shall consist of broken stone or screened gravel stone conforming to the following requirements:

*Broken Stone.* The broken stone shall consist of clean, hard, tough, durable rock, free from soft, thin, elongated or laminated pieces, disintegrated stone, vegetable or other deleterious matter, and shall have a French coefficient of wear not less than eight (8).

*Screened Gravel Stone.* Screened gravel stone shall consist of clean, hard, tough, durable rock, free from soft, thin, elongated or laminated pieces, disintegrated stone, vegetable or other deleterious matter, and shall have a percentage of wear of not more than 15 when tested according to the Bureau of Public Roads Bulletin No. 949, page 3.

When tested by means of laboratory screens the coarse aggregate shall meet the following requirements: Per Cent.

Passing 2½ inch screen.....	100
Passing 2 inch screen.....	not less than 95
Passing 1 inch screen.....	50 to 75
Passing ½ inch screen.....	15 to 25
Passing ¼ inch screen.....	not more than 5

At no time shall aggregates be piled on the sub-grade or upon the sides of the road, except that large stock piles may be formed at central points. When stock piles are formed at loading plants or at other distributing points, the materials shall be piled on space that has been properly prepared and the piles shall be of such shape and size that materials may be stored and handled without becoming dirty or mixed with deleterious substances.

(f) *Transverse Joint Filler.* The transverse joint filler shall consist of prepared bituminous paving strips of a quality approved by the Engineer, one (1) inch wider than the thickness of the concrete surfacing, of a length equal to the width of the concrete slab, and one-half (½) inch in thickness.

(g) *Bituminous Material for Longitudinal Joint.* The bituminous material for the longitudinal joint shall meet the following requirements:

1. Specific gravity 25°/25° C. (77°/77° F.).....	not less than 0.980
2. Flash point.....	not less than 200° C. (392° F.)
3. Melting point.....	not less than 80° C. (172° F.)
4. Penetration at 25° C. (77° F.), 100 g., 5 sec.....	30 to 50
5. Loss at 163° C. (325° F.), 5 hours.....	not more than 1.0 per cent.
Penetration of residue at 25° C. (77° F.), 100 g., 5 sec.....	not less than 20
6. Total bitumen (soluble in carbon disulphide).....	not less than 99.5 per cent.

a. Organic matter insoluble..... not more than 0.2 per cent.

(h) *Reinforcing Materials and Dowels.* The steel which does not have to be bent shall conform to the requirements of the Standard Specifications of the American Society for Testing Materials for Billet Steel Concrete Reinforcement Bars, Serial Designation A15-14, or for Rail Steel Concrete Reinforcement Bars, Serial Designation A16-14, and for steel which has to be bent to the requirements for Billet Steel Concrete Reinforcement Bars, Serial Designation A15-14.

*Steel Rod Reinforcement.* The steel rod reinforcement shall consist of deformed steel rods with a cross-section area of twenty-five hundredths (0.25) square inches.

*Wire Mesh Reinforcement.* Wire mesh reinforcement shall consist of galvanized rectangular, electrically welded, or triangular steel wire mesh, and weighing approximately sixty-five (65) pounds per one hundred (100) square feet.

The steel wire used in the manufacture of the above mesh shall meet the requirements of the Tentative Specifications of the American Society for Testing Materials for Cold-Drawn Steel Wire for Concrete Reinforcement, Serial Designation A82-21T.

*Dowels.* Dowels shall be deformed steel rods for longitudinal joints, and plain steel rods for the transverse joints, and shall be not less than forty (40) inches long with a cross-section area of twenty-five hundredths (0.25) square inches.

**Section 55. CONSTRUCTION METHODS.** (a) *Side Forms.* The forms shall be joined neatly and tightly, shall be set true to line and grade, well staked and braced, and shall have uniform bearing on the sub-grade throughout their entire length. In general the setting of forms shall proceed at least two hundred (200) feet in advance of the mixing and placing of concrete. The forms shall be thoroughly cleaned before any concrete is placed against them.

The forms shall be made tight to prevent the leaking of mortar from the concrete.

The forms shall be of wood or metal, of a width equal to the depth of the concrete, true to line, free from warp and of sufficient strength, when staked, to resist the pressure of the concrete without springing, and so designed that the various sections may be fastened together in such a manner as to prevent vertical or horizontal movement of the ends.

If of wood, they shall be two (2) inch surfaced plank not less than twelve (12) feet in length unless otherwise ordered by the Engineer. The top of the wooden forms shall be bound with angle irons according to the directions of the Engineer. If of metal, they shall be of approved section satisfactory to the Engineer.

(b) *Devices for Measuring Materials.* The accurate measurement of each of the materials composing and the production of a uniform mixture of the concrete are essential. The Contractor shall furnish and use approved timing devices, a water measuring and discharging device, also boxes or pans of such dimensions as will give, when filled and struck, the exact volumes of aggregate required by the Engineer.

(c) *Composition.* The concrete shall be composed by volume of one (1) part of Portland cement, eight hundredths (8/100) of a part of hydrated lime, two (2) parts of fine aggregate, and four (4) parts coarse aggregate. Not less than five hundred and sixty-four (564) pounds of cement shall be used for each cubic yard of concrete.

No cement shall be shipped to the work until it has been subjected to the Department's sampling and tests at the mill, unless otherwise ordered by the Engineer.

(d) *Consistency.* The materials shall be mixed wet enough to produce a concrete which will flatten out and quake when deposited in place, but not enough to cause it to flow, or the mortar and coarse aggregate to separate.

The water shall be accurately measured and gauged, and shall be automatically discharged into the drum with the aggregates. The quantity of water shall be determined by the Engineer and not varied without his consent.

(e) *Mixing Conditions.* Concrete shall not be mixed or placed when the temperature is at or lower than thirty-five (35) degrees F., and no materials containing frost shall be used. Cement or aggregate containing lumps or crusts of hardened material shall not be used.

The concrete shall be mixed only in such quantity as is required for immediate use and any which has developed initial set or has been mixed longer than thirty (30) minutes shall not be used. Remixing with additional water, mortar or concrete that has partially hardened will not be permitted.

(f) *Mixing Concrete.* Concrete shall be mixed thoroughly in a batch mixer of a type approved by the Engineer, for a period of not less than one and one-half (1½) minutes after all the materials are in the drum and during this period shall make not less than fourteen (14) nor more than twenty (20) revolutions per minute.

The entire contents shall be removed from the drum before materials are placed therein for the succeeding batch.

(g) *Placing Concrete.* Concrete shall be placed only on a moist sub-grade. If the sub-grade is dry it shall be sprinkled with as much water as will be readily absorbed.

In no case shall concrete be deposited upon a frozen sub-grade.

If the mixer is operated on the sub-grade, planks shall be provided for the mixer to run on, so that the sub-grade shall be kept in good condition.

The concrete shall be deposited on the sub-grade, between the side forms, rapidly in successive batches, by means of a discharging device which does not cause separation of the mortar and the coarse aggregate, and shall be distributed to the required depth and for the entire width of the surfacing by shoveling or other approved methods. Rakes shall not be used for handling concrete.

This operation shall be continuous, completing sections between expansion or contraction joints without the use of intermediate forms or bulkheads.

(h) *Placing of Steel Rod Reinforcement.* The steel reinforcing rods shall be placed as shown on the plans and in such manner as to insure their remaining in the desired position during the placing and hardening of the concrete.

The steel rods for reinforcement shall be supported and held in position during the placing of the concrete by steel pins or other metal mechanical device such as the Engineer will approve of. The pins or other device used for supporting the steel at the upper portion of the slab shall be left in place and such pins or supports shall be spaced not more than 4 feet 6 inches on centers.

(i) *Placing of Wire Mesh Reinforcement.* The steel wire mesh reinforcement shall be laid in strips transversely with the roadway and shall lap six (6) inches. The wire mesh reinforcement shall be placed as shown on the plans and in such a manner as to insure its remaining in the desired position during the placing and hardening of the concrete.

(j) *Placing of Dowels.* Dowels shall be placed as shown on plans and in such manner as to insure their remaining in the desired position during the placing and hardening of the concrete. The dowels for the transverse joints shall be painted for one-half their length with bituminous material hereinbefore specified for longitudinal joints.

(k) *Transverse Expansion or Contraction Joints.* Transverse expansion or contraction joints shall be placed not more than sixty (60) feet apart and shall be made perpendicular to the surface of the pavement entirely through the concrete and perpendicular to the center line of the surfacing.

(l) *Longitudinal Joint.* A longitudinal joint shall be placed in the center line of the concrete surfacing. The space made by rounding the upper edges of the longitudinal joint shall be filled to the upper surface of the concrete surfacing with bituminous material. Only one-half of the width of the concrete surfacing shall be constructed at one time and the face of the concrete at the longitudinal joint shall be painted with bituminous material before the other half of the concrete surfacing is placed. The bituminous material for filling and painting the longitudinal joint shall conform to the requirements of Section 54 (g).

(m) *Finishing Concrete.* The surface of the concrete shall be struck off by means of a steel template of approved section weighing not less than two hundred (200) pounds for a length equal to the width of the surfacing. The template shall be rolled to the desired cross-section and have sufficient strength to retain its shape under all working conditions. This template shall be moved with a longitudinal and crosswise motion, moving always in the direction in which the work is progressing. Care shall be taken in moving the template forward that it is not lifted from the side forms, but shall be held securely against the top of the forms and moved forward uniformly, thus preventing undulations in the surface.

Immediately after the concrete has been struck off it shall be finished by using a belt of wood, canvas, or rubber, not less than six (6) nor more than twelve (12) inches wide, and at least two (2) feet longer than the width of the pavement. The belt shall be applied with a combined crosswise and longitudinal motion. For the first application vigorous strokes at least twelve inches long shall be used, and the longitudinal movement along the pavement shall be very slight. The second application of the belt shall be immediately after the water sheen disappears, and the stroke of the belt shall be not more than four inches, and the longitudinal movement shall be greater than for the first belting. Care shall be observed in the use of the belt not to permit the edges to dig into the surface of the concrete or to work the crown out of the surfacing.

The surface of the pavement shall be tested after the belting with a straight edge laid parallel to the center line of the pavement to detect waves and irregularities in the surface and such waves and irregularities must be corrected immediately.

The concrete adjacent to the transverse joint shall be finished with a split wood float which will insure finishing both sides to the same grade, after which the upper edges of the concrete at the transverse joint shall be rounded to a radius of three-sixteenths ( $\frac{3}{16}$ ) of an inch.

The upper edges of the longitudinal joint and the outer sides of the concrete shall be rounded to a radius of three-quarters ( $\frac{3}{4}$ ) of an inch.

The rounding of the joints shall be done with an approved edging tool. The finishing of the joints shall be done from a bridge which shall not rest on the concrete at any point.

Forms shall not be removed for twenty-four (24) hours (or for a longer period if directed by the Engineer) after the concrete has been placed.

Concrete surface finishing machines of a type approved by the Engineer may be used as an alternate method of finishing to that described above, but when an approved finishing machine is used, an experienced operator, satisfactory to the Engineer, must at all times be in charge of the machine and if the Engineer directs, the machine finisher shall be immediately followed by the belt of the same kind as specified above.

Finally the surfacing shall be lightly broomed with stable or wire brooms.

(n) *Protection of Concrete.* As soon as finished (except in cold weather), the concrete shall be protected by a canvas covering, suspended not less than twelve (12) inches above the surface, and if directed, the surface of the pavement shall be sprinkled with water. When the concrete has hardened sufficiently, the canvas covering shall be removed and the entire surface of the pavement wetted thoroughly and covered with earth or other approved material to a depth of not less than two (2) inches. This material shall be kept moist by sprinkling with water, if directed, and shall remain on the concrete for a period of not less than ten (10) days under the most favorable conditions, or for a longer period if directed by the Engineer, during which time traffic shall

be excluded from the concrete by the erection and maintenance of suitable barricades, and satisfactory precautions shall be taken to exclude foot traffic for a period of not less than three (3) days. When required or approved, other methods of curing and protecting the concrete may be used.

After the foregoing period has elapsed, the covering on the concrete shall be removed, the surface of the pavement swept clean and the concrete allowed to cure for a period of three (3) days, after which the roadway may be open to traffic.

During cold weather, the concrete shall be protected by covering it with a canvas cover, supported above the surface of the pavement by wood frames, so that the canvas will not rest upon the surface of the concrete. When the concrete has hardened sufficiently, the canvas cover and frames shall be removed and the entire surface of the pavement shall be covered with straw or other approved material, to a depth of not less than six (6) inches. It shall remain in place not less than three (3) days and traffic shall be excluded from the pavement for at least eighteen (18) days thereafter or for a longer period if required by the Engineer. When required or approved, other methods of curing and protecting the concrete may be used.

When in the opinion of the Engineer, it is necessary to provide for traffic across the concrete surfacing, the Contractor shall at his own expense construct suitable crossings to bridge over the concrete.

**Section 56. BASIS OF PAYMENT.** This work shall be paid for as follows: The concrete shall be paid for at the contract unit price per cubic yard for "Reinforced Cement Concrete Surfacing," complete in place, which price shall include all concrete and contraction or expansion joint and longitudinal joint materials, all forms, equipment, tools, labor, including belting, protection of concrete, wetting, and all work incidental thereto.

The steel reinforcement, pins or supports (when left in place), and dowels shall be paid for at the contract unit price per pound for "Steel reinforcement and dowels" in place, which price shall include all materials, all equipment, labor and work incidental thereto.

#### Cement Concrete Masonry.

**Section 57. DESCRIPTION.** Cement concrete for structures shall be composed of broken stone or screened gravel, sand, Portland cement and water. The materials shall be mixed in the proportions and of the consistency specified. The cement, broken stone or screened gravel stone and sand shall be proportioned by volume. The concrete shall be of two classes, plain and reinforced.

Each class of concrete shall be used in that part of the structure in which it is called for on the plans, or where directed by the Engineer.

**Section 58. PLAIN CONCRETE.** Plain concrete shall be composed of one (1) part of Portland cement, two and one-half (2½) parts of sand and five (5) parts of broken stone or screened gravel, and such a proportion of water as the Engineer may from time to time determine.

**Section 59. REINFORCED CONCRETE.** Reinforced concrete shall be composed of one (1) part of Portland cement, two (2) parts of sand and four (4) parts of broken stone or screened gravel, such a proportion of water as the Engineer may from time to time determine, and reinforced with deformed bars and such other reinforcement, as is shown on plans.

**Section 60. PORTLAND CEMENT.** The cement used shall meet the requirements of the standard specifications and tests for Portland cement, adopted by the American Society for Testing Materials, January 1, 1921, with all subsequent amendments and additions thereto adopted by said Society.

Every facility shall be provided the Engineer for careful sampling and inspection of the cement either at the mill or at the site of the work as may be specified by the Engineer. At least ten (10) days from the time of sampling shall be allowed for the completion of the seven day test; and at least thirty-one (31) days shall be allowed for the completion of the twenty-eight (28) day test. The twenty-eight day test shall be waived only when specifically ordered.

**Section 61. WATER.** The water used shall be free from oil, acid, alkalies, or organic matter, and neither brackish nor salt.

**Section 62. SAND.** The sand shall consist of grains or particles of quartz or other hard and durable rocks, the surfaces of which are not coated with any foreign material nor worn smooth. The grains shall be moderately sharp, free from soft, decomposed or partly decomposed sand grains, lumps of clay, or ferruginous cemented sand, mica, loam, sea salts, organic matter or other foreign materials.

The sand shall be well graded from coarse to fine and when tested by means of laboratory screens and sieves shall meet the following requirements:

	Per Cent.
Passing $\frac{1}{4}$ inch screen .....	100
Passing 20 mesh sieve .....	30 to 75
Passing 50 mesh sieve not more than .....	28
Passing 100 mesh sieve not more than .....	8
By elutriation test not more than .....	3

The sand shall be of such quality that mortar composed of one (1) part Portland cement and three (3) parts sand by weight when made into briquettes will show a tensile strength at seven and twenty-eight days at least eighty-five (85) per cent of the tensile strength of one (1) to three (3) mortar of the same consistency made with the same cement and standard sand.

**Section 63. BROKEN STONE OR SCREENED GRAVEL STONE.** The broken stone or screened gravel stone shall consist of clean, durable rock, free from soft, thin, elongated or laminated pieces, disintegrated stone, vegetable or other deleterious matter.

The stone shall meet the following requirements:

French coefficient of wear not less than eight (8).

The broken stones or gravel stones shall be of the following sizes:

For all work less than six (6) inches in thickness the stones may vary in their longest dimensions from one-quarter ( $\frac{1}{4}$ ) of an inch to three-quarters ( $\frac{3}{4}$ ) of an inch; between six (6) inches and twelve (12) inches, from one-quarter ( $\frac{1}{4}$ ) of an inch to one and one-quarter ( $1\frac{1}{4}$ ) inches; more than twelve (12) inches in thickness, from one-quarter ( $\frac{1}{4}$ ) inch to two and one-half (2½) inches.

**Section 64. FORMS.** Centers and forms, satisfactory to the Engineer, shall be provided by the Contractor. They shall be made of planed lumber and shall fit the curves and shapes of the work. The sheathing shall be laid tight to prevent the leaking of mortar from the concrete.

The centers shall be true to the lines, satisfactorily supported and firmly secured, and remain in place as long as the Engineer may direct, and shall be replaced by new ones when they lose their proper dimensions or shape.

Before using the forms they shall be thoroughly cleaned, and some adequate means, such as the use of paraffin, oils, etc., shall be taken to insure non-adhesion of the concrete to the forms.

**Section 65. DEVICES FOR MEASURING MATERIALS.** The accurate measurement of each of the materials and the production of a uniform mixture of the concrete are essential. The Contractor shall furnish and use approved timing devices, a water measuring and discharging device, also boxes or pans of such dimensions as will give, when filled and struck, the exact volume of aggregate required by the Engineer.

**Section 66. CONSISTENCY.** The materials shall be mixed wet enough to produce a concrete of a consistency that will flush readily under light tamping, but which can be handled without causing a separation of the coarse aggregate from the mortar.

**Section 67. MIXING CONDITIONS.** The concrete shall be mixed only in such quantities as are required for immediate use, and any which has developed initial set or has been mixed longer than thirty (30) minutes shall not be used.

If at any time during the progress of the work the temperature is, or, in the opinion of the Engineer, will within twenty-four (24) hours drop to 33 degrees F., the water and aggregate shall be heated and the concrete shall be covered with canvas or burlap.

If the temperature continues below 33 degrees F. during the day or night, the Contractor shall, if ordered by the Engineer, heat the concrete in the forms until it is thoroughly set, with steam or salamanders, without additional compensation.

No concrete shall be placed when, in the opinion of the Engineer, it cannot be kept from freezing until it has thoroughly set and properly hardened, and work shall be entirely stopped when so ordered by the Engineer.

The temperature of the concrete mixture shall not be less than 60° F. when it reaches its final position in the forms; but excessive heating must be avoided. Salt or calcium chloride shall not be used in the concrete mixture.

**Section 68. MIXING CONCRETE.** The concrete shall be mixed thoroughly in a batch mixer of a type approved by the Engineer, for a period of not less than one and one-half (1½) minutes after all the materials are in the drum and during this period shall make not less than fourteen (14) nor more than twenty (20) revolutions per minute.

The entire contents shall be removed from the drum before materials are placed therein for the succeeding batch.

When permitted by the Engineer, hand mixing shall be done on a water-tight wood or metal surface of suitable size.

The cement and sand shall first be thoroughly mixed dry, in the proportions specified. Clean water shall then be added and the materials thoroughly mixed. The broken stone, previously drenched with water, shall then be deposited in this mixture and the ingredients thoroughly mingled and turned over until each stone is covered with mortar. Remaking with additional water, mortar or concrete that has partially hardened will not be permitted.

**Section 69. PLACING CONCRETE.** Concrete shall be placed in the forms immediately after mixing, carefully leveled and lightly tamped to fill all voids and secure a dense, homogeneous mass. The stone shall also be carefully worked back from the forms by means of spades or special tools, so as to bring the mortar next to the forms and produce a dense face.

The concrete shall not be allowed to fall from any considerable height.

In laying concrete under water the concrete shall not fall from any considerable height, but be deposited in the allotted place in a compact mass. The concrete must not be disturbed after being deposited. No concrete shall be laid in running water.

**Section 70. CONNECTION OF NEW AND OLD CONCRETE.** In connecting concrete already set with new concrete, the surface shall be cleaned and roughened and mopped with a mortar composed of one part Portland cement and one part sand.

**Section 71. CONCRETE PROTECTION.** Precautions shall be taken to thoroughly protect the concrete from damage by rain and frost during and after laying.

During warm and dry weather, and whenever the Engineer may direct, all newly built concrete shall be kept well shaded from the sun and well sprinkled with water until set.

**Section 72. DEFECTIVE WORK.** Any defective work discovered after the forms have been removed shall be removed immediately and replaced. If the surface of the concrete is bulged, uneven, or shows excess honeycombing or form joint-marks, which, in the opinion of the Engineer, cannot be repaired satisfactorily, the entire section shall be removed and renewed. All repairs and renewal due to defective work shall be done at the expense of the Contractor.

**Section 73. FINISHING CONCRETE.** All exposed concrete surfaces shall be true and even, free from depressions or projections.

All exposed surfaces shall be brought to a smooth, neat finish by rubbing with a block of wood and sand or carborundum brick, except as otherwise provided for on the plans for the work.

**Section 74. BACKFILLING.** No backfilling or loading whatever shall be placed on or against the concrete masonry until ordered by the Engineer.

The backfilling shall consist of material satisfactory to the Engineer, and shall be formed of successive layers of not more than six (6) inches in depth, each layer being thoroughly tamped before the succeeding layer is placed.

Backfill in front of substructures of bridges shall be made with the stone removed in excavating for the foundations and if additional stone is required to complete the fill, as ordered by the Engineer, it shall be paid for at the contract unit price per cubic yard for riprap.

The filling immediately back of abutments and wing walls of bridges shall be made with clean gravel, broken stone or slag, for a width of two feet parallel to the back face of these walls, from the bottom of the foundations to the sub-grade of the road. The gravel shall be composed of hard, durable stone practically free from loam and clay, shall contain no stones measuring over three inches in their longest dimensions, and shall be paid for at the contract unit price per cubic yard for gravel borrow.

In no case shall the bridge be loaded until thirty days have elapsed after placing the last concrete in the bridge floor.

**Section 75. MEASUREMENT OF CONCRETE.** All measurements of concrete shall be in accordance with the dimensions shown on the plans, unless changes are ordered by the Engineer during construction.

### Reinforcement.

**Section 76. DESCRIPTION.** All reinforcement for concrete structures shall consist of deformed bars, unless otherwise specified.

If curb bars are shown on the plans they shall be considered as reinforcement.

**Section 77. MATERIALS.** All deformed bars shall meet the requirements of standard specifications for the American Society for Testing Materials for Billet Steel Concrete Reinforcing Bars, Serial Designation A15-14.

All other reinforcing materials shall be of a quality and type satisfactory to the Engineer.

All reinforcement shall be free from rust, dirt, oils, paint, grease and mill scale, and shall present a clean, fresh surface when placed in the structure.

All steel showing imperfections shall be rejected. If impracticable to obtain bars of the full length required, they may be lapped by each other to an extent equal to forty (40) diameters.

**Section 78. PLACING REINFORCEMENT.** The steel shall be bent true to templates and shall be placed accurately as shown on plans. The reinforcement shall be placed in such a manner as to insure its remaining in the desired position during the placing and hardening of the concrete.

**Section 79. BASIS OF PAYMENT FOR PLAIN AND REINFORCED CONCRETE.** The plain concrete shall be paid for at the contract unit price per cubic yard for "Plain Concrete Masonry," complete in place. The reinforced concrete shall be paid for at the contract unit price per cubic yard for "Reinforced Concrete Masonry," complete in place.

The above prices shall include all construction and removal of forms, reinforcement for reinforced concrete masonry, materials, labor, backfilling, tools, machinery, and such other appliances and equipment not otherwise herein provided for, as may be required to properly execute the work in accordance with these specifications. No allowance will be made for cofferdams, pumps, pumping or bailing, or for any materials, except concrete, equipment, or labor necessary on account of water or unstable materials, or for heating and protecting in cold weather.

#### Rubble Concrete Masonry.

**Section 80. DESCRIPTION.** Rubble concrete masonry shall be composed of "Plain Concrete" with boulders incorporated therein, and shall be used in foundations of structures as shown on the plans.

**Section 81. MATERIALS.** "Plain Concrete" shall conform to the requirements of Plain Concrete Masonry hereinbefore specified.

The boulders shall consist of stones not exceeding one man stones, broken and presenting sharp edges.

**Section 82. CONSTRUCTION METHODS.** The boulders shall be thoroughly cleaned and wet and incorporated into the "Plain Concrete" as follows:

On any rammed layer of "Plain Concrete," boulders shall be bedded not less than eight (8) inches from each other or from the forms, and the spaces between the boulders and between the boulders and the forms shall be filled with thoroughly rammed "Plain Concrete."

**Section 83. BASIS OF PAYMENT.** The rubble concrete masonry shall be paid for at the contract unit price per cubic yard for Rubble Concrete masonry, complete in place.

The above price shall include all construction and removal of forms, all materials, labor, backfilling, tools, machinery, and such other appliances and equipment not otherwise herein provided for, as may be required to properly execute the work in accordance with these specifications. No allowance will be made for cofferdams, pumps, pumping or bailing, or for any materials (except concrete), equipment, or labor necessary on account of water or unstable materials.

#### Cement Rubble Masonry.

**Section 84. DESCRIPTION.** Cement rubble masonry shall consist of coursed rubble of good quality laid in Portland cement mortar according to these specifications.

**Section 85. MATERIALS.** The stone shall be hard and durable, free from seams or other imperfections and of a quality and shape approved by the Engineer. No stone shall be less than six (6) inches in thickness unless otherwise directed by the Engineer. No stone shall measure less than twelve (12) inches in its least horizontal dimension or less than its thickness.

Mortar shall be composed of one (1) part Portland cement and two (2) parts sand. The cement, water and sand shall meet the requirements specified in Sections 60, 61 and 62 respectively.

**Section 86. CONSTRUCTION METHODS.** The stones shall be roughly squared in joints, beds and faces, laid so as to break joints and in full mortar beds. All vertical spaces shall be flushed with good cement mortar and shall be packed full of spalls. No spalls shall be allowed in the beds. At least one-fourth ( $\frac{1}{4}$ ) of the stone in the face shall be headers evenly distributed throughout the wall.

**Section 87. BASIS OF PAYMENT.** All cement rubble masonry shall be paid for at the contract unit price per cubic yard for cement rubble masonry in place, which price shall include all materials, and incidental work, but not including excavation. No allowance will be made for cofferdams, pumps, pumping or bailing, or for any materials (except concrete), equipment, or labor necessary on account of water, or unstable materials.

#### Drainage Structures.—Concrete Culverts, End Walls, Drop Inlets.

**Section 88. DESCRIPTION.** All concrete culverts, end walls for culverts and drop inlets shall be built of the class of concrete indicated on the plans and in conformity with these specifications.

**Section 89. MATERIALS.** The materials used shall meet the requirements specified elsewhere herein for the class of concrete to be used.

**Section 90. CONSTRUCTION METHODS.** These structures shall be constructed in accordance with the specifications contained herein for the kinds of work being done and conforming to the lines, grades, measurements and designs shown on the plans.

**Section 91. BASIS OF PAYMENT.** Concrete culverts, end walls for culverts, and drop inlets shall be paid for at the contract unit prices for the class of work performed.

No allowance will be made for cofferdams, pumps, pumping or bailing, or for any materials (except concrete), equipment, or labor necessary on account of water or unstable material.

#### Catch Basins and Manholes.

**Section 92. DESCRIPTION.** Catch basins and manholes shall be built of brick masonry or of "Plain Concrete" masonry.

**Section 93. MATERIALS.** For brick masonry, the cement, water and sand shall meet the requirements specified in Sections 60, 61 and 62 respectively.

The brick shall be new, well formed whole brick of the best quality, burned hard entirely through, free from injurious cracks and flaws, tough and strong, and shall have a clear ring when struck together.

The materials for "Plain Concrete" masonry shall conform to Sections 60, 61, 62 and 63.

Castings for frames, covers, gratings, etc., shall be composed of the best quality tough, gray iron free from cold shuts, blowholes and other imperfections. The casting shall be sound, true to form and size, clean and neatly finished, and coated with coal tar pitch varnish.

**Section 94. CONSTRUCTION METHODS.** Catch basins and manholes shall be built to the lines, grades, dimensions and designs shown on the plans with the necessary frames, gratings, covers, etc., and in accordance with these specifications.

**BRICK MASONRY.** The bricks shall be well soaked in water before laying. The joints shall be thoroughly flushed full of mortar, consisting of one part of Portland cement and two parts sand. No joint on the face shall be greater than one-quarter inch. After the bricks are laid, the joints shall be neatly pointed on the inside. As the walls are laid up they shall be well plastered with mortar on the outside.

Plain Concrete Masonry shall conform to the requirements for Plain Concrete Masonry hereinbefore specified.

Frame castings for catch basins and manholes shall be set in full mortar beds.

All surplus material from excavation for catch basins and manholes shall be used within the location of the highway, if so directed by the Engineer, without additional compensation. If not so used, the Contractor shall remove such material from the highway at his own expense.

**Section 95. BASIS OF PAYMENT.** Catch basins or manholes shall be paid for at the contract price each respectively for "Catch Basins" or "Manholes," complete in place, which price shall include all labor, tools and materials necessary for the basins excepting the frames and grates, which will be furnished by the Selectmen, delivered at the railroad freight station nearest to the site of the work.

The price paid for each basin or manhole shall also include all excavation (except ledge), backfilling, teaming the frames and grates to the work, disposal of surplus material and all other incidental work. No allowance will be made for pumps, pumping or bailing, or for any materials, equipment, or labor necessary on account of water or unstable material.

### Leaching Basins.

**Section 96. DESCRIPTION.** Leaching basins shall be built of dry rubble stone masonry and of brick masonry, shall have a cast iron frame and grating at the top, and shall be built according to the plans, in accordance with these specifications.

**Section 97. MATERIALS.** The cement, water, sand, brick, and castings for frames and grates shall conform to the requirements specified in sections 60, 61, 62 and 93 respectively.

The stone shall be hard and durable, free from seams or other imperfections and of a quality and shape approved by the Engineer.

No stone shall be less than six (6) inches in thickness unless otherwise directed by the Engineer.

**Section 98. CONSTRUCTION METHODS.** Leaching basins shall be built to the lines, grades, dimensions and designs shown in the plans with the necessary frames, gratings, etc., and in accordance with these specifications.

The stones shall be roughly squared on joints, beds and faces and laid so as to break joints.

No spalls shall be allowed in the beds. The brick masonry shall be constructed and the frames and gratings shall be set as specified under Section 94.

All surplus material from excavation for leaching basins shall be used within the location of the highway, if so directed by the Engineer, without additional compensation. If not so used, the Contractor shall remove such material from the highway at his own expense.

**Section 99. BASIS OF PAYMENT.** Leaching Basins shall be paid for at the contract price each for "Leaching Basins," complete in place, which price shall include all labor, tools and materials necessary for the basins excepting the frames and grates, which will be furnished by the Selectmen, delivered at the railroad freight station nearest to the site of the work.

The price paid for each basin shall also include all excavation (except ledge), backfilling, teaming the frames and grates to the work, disposal of surplus material and all other incidental work. No allowance will be made for pumps, pumping or bailing, or for any materials, equipment, or labor necessary on account of water or unstable material.

### Curbstone Inlets.

**Section 100. DESCRIPTION.** Curbstone inlets shall be set to the required line and grade and in accordance with these specifications.

**Section 101. MATERIALS.** The stone shall be hard and durable, free from seams or other imperfections, six (6) feet in length, from sixteen (16) to eighteen (18) inches in depth, and seven (7) inches thick at the top. The top and sides at the upper part shall be bush hammered and the front face shall be dressed at least nine (9) inches in depth and the back face four (4) inches in depth, and on the face a gutter mouth shall be cut out to a depth four (4) inches and a length of two (2) feet as shown on plan.

The gravel used shall conform to the requirements of Section 14.

**Section 102. CONSTRUCTION METHODS.** The curbstone inlets shall be placed to the required line and grade in full mortar bed on the back walls of the catch basins, and on a gravel bed in the trench outside of the catch basin walls.

The trench shall be two (2) feet in depth and eighteen (18) inches in width.

Gravel shall be placed in the trench from the bottom of the trench to the bottom of the curbstone and on each side of the curbstone from the bottom to the top of the curbstone. The gravel shall be thoroughly tamped.

**Section 103. BASIS OF PAYMENT.** All curbstone inlets shall be paid for at the contract price each for curbstone inlets, complete in place, which price shall include all materials (except gravel), all excavation excepting ledge and all other incidental work. The gravel used shall be paid for at the contract unit price per cubic yard for gravel borrow.

### Concrete Curbstone Inlets with Curb Bar.

**Section 104. DESCRIPTION.** Concrete curbstone inlets shall be set to the required line and grade and in accordance with these specifications.

The upper edge of the face of the inlet shall be protected with a galvanized steel curb bar.

**Section 105. MATERIALS.** The cement, water, sand and broken stone or screened gravel shall conform to the requirements of Sections 60, 61, 62 and 63 respectively, excepting that the size of the stone shall vary from one-half ( $\frac{1}{2}$ ) to one and one-quarter ( $1\frac{1}{4}$ ) inches in their largest dimensions.

The inlet shall be six (6) feet in length, twenty-four (24) inches in depth, six (6) inches in width at the top, and seven (7) inches in width at the bottom.

The gutter mouth on the face shall be two (2) feet in length and the depth shall be four (4) inches as shown on plans.

The curb bar shall be made of steel of good quality and galvanized and shall be of a type satisfactory to the Engineer.

The gravel used for backfilling shall conform to the requirements of Section 14.

**Section 106. CONSTRUCTION METHODS.** The concrete curbstone inlet shall be moulded separately from the catch basin and placed to the required line and grade on the back walls of the catch basins and on a gravel bed in the trench outside of the catch basin walls.

The trench shall be eighteen (18) inches wide, and its sub-grade is to be twenty-eight (28) inches below the top of the finished curbstone.

Upon this sub-grade good, clean, coarse gravel shall be placed and thoroughly tamped so that it will be four (4) inches in depth after tamping.

The curb bar shall be placed to the satisfaction of the Engineer immediately following the placing of the concrete, in the upper edge of the face of the curb inlet.

The concrete shall be of such consistency and be so spaded and worked that a smooth mortar face will be produced.

All forms shall be held rigidly in position. They shall be either of metal or of acceptable planed and matched lumber, and of such construction that a smooth surface will be provided.

The concrete shall be left in the forms until it has set sufficiently so that in the opinion of the Engineer they can be removed without injury to the curb inlet. The curb inlet shall immediately upon the removal of the forms be rubbed down to a smooth and uniform surface, but no plastering will be allowed. For this work a competent and skillful finisher shall be employed.

The Contractor shall protect the curb inlet and keep it in first-class condition until the completion of the contract. Any curb inlet which is damaged at any time previous to the final acceptance of the work shall be removed and replaced with a satisfactory curb inlet at the Contractor's expense.

The trench shall be backfilled with gravel to the depth ordered by the Engineer and thoroughly tamped, care being taken not to affect the line or grade of the curbstone inlet.

**Section 107. BASIS OF PAYMENT.** All curbstone inlets shall be paid for at the contract price each for concrete curbstone inlets complete in place.

The above price shall include all materials (except gravel), all excavation (except ledge), and all other incidental work. The gravel used shall be paid for at the contract unit price per cubic yard for gravel borrow.

## Pipe Culverts.

**Section 108. DESCRIPTION.** These culverts shall consist of sections of cast-iron pipe, corrugated iron pipe, vitrified clay or cement concrete sewer pipe, and reinforced concrete pipe, laid on a firm bed in accordance with these specifications.

The kind of pipe to be used will be given in the "Proposal."

**Section 109. MATERIALS.** All cast-iron pipe shall be cast-iron water pipe, with bell and spigot ends, or cast-iron culvert pipe. The thickness to be uniform throughout the length and perimeter of the pipes.

The pipes shall be thoroughly coated with asphaltum.

If cast-iron water pipe is furnished, it shall be Class "A," but may be of light weight and second quality.

If cast-iron water pipe is furnished, the **minimum** thickness of pipe and the weights per linear foot shall be as follows:

Normal Inside Diameter, Inches.	Thickness, Inches.	Weight per Foot, Pounds.
12	$\frac{3}{8}$	55
16	$\frac{7}{16}$	70
18	$\frac{1}{2}$	90
20	$\frac{1}{2}$	120
24	$\frac{9}{16}$	150
30	$1\frac{1}{16}$	220
36	$1\frac{3}{16}$	290

No pipe will be accepted, the weight of which shall be over five (5) per cent less than the weights herein specified.

All cast-iron pipe shall be free from all defects impairing its strength or utility.

All corrugated metal pipe shall be of first quality, of true circular form and shall be of such lengths as are indicated on the plans. The pipe shall be true and straight throughout its entire length and free from all imperfections. It shall have tightly riveted lap joints, and the rivets shall be of a quality and galvanizing at least equal to the metal used in the pipe.

**COMPOSITION OF METAL.** All corrugated metal culvert pipe shall be fabricated from corrugated galvanized sheets in which the base metal shall meet one of the three (3) following requirements:

Alloy.	Metalloids.	Iron.	Iron.	Steel.
— Copper.	Sulphur Total of Carbon, Sulphur, Phosphorus, Manganese, Silicon : : : —	Not more than 0.04%. Not more than 0.14%. Optional.	Not more than 0.04%. Not more than 0.30%. 0.18-0.30%.	Not more than 0.06%. Not more than 0.70%. 0.18-0.30%.

**GALVANIZING.** All sheet metal used (meeting one of the three above requirements) in the manufacturing of the corrugated pipe shall be coated for each square foot with not less than two (2) ounces of spelter, evenly distributed over both surfaces. The spelter shall be pure zinc, and shall be applied in such manner as to form a continuous, impervious coating of uniform thickness, free from imperfections of any kind, and shall show no signs of cracking or blistering.

**CORRUGATIONS.** The corrugations shall be not more than three (3) inches in width and not less than one-half ( $\frac{1}{2}$ ) an inch in depth.

**GAUGES OF METAL.** Corrugated metal culverts shall be made of sheets of the following thickness (United States Standard Gauge Measure):

All Vitrified Clay Pipes shall be of first quality, salt-glazed, free from blisters and cracks, straight and round and with bell and spigot ends.

If eighteen (18) inches or more in diameter the pipe shall be "double strength."

All cement Concrete Sewer Pipe shall be made of the same materials and in the manner specified for machine-made reinforced concrete pipe, given below, with the exception that no reinforcing metal is required and the ultimate strength of pipe shall be 1,000 D in the formula for reinforced concrete pipe. The dimensions for this kind of pipe and its strength shall conform to the requirements of the A. S. T. M. Specifications, Serial Designation C14-21.

Reinforced concrete pipe may be either cast or machine-made. Each type shall conform in size, shape and reinforcement to the standards as shown in the table forming a part in these specifications. The letter C or M shall be plainly impressed upon

the outside surface of each length of pipe to designate whether it is cast or machine-made respectively. Each length of pipe shall also be clearly marked with the date of manufacture and the name or trade mark of the manufacturer.

All concrete pipe 12" or over in diameter shall be reinforced as herein specified and be of the bell and spigot type or of other approved type. Each section shall have square ends, be circular in cross-section, unless otherwise specified, and have walls of uniform thickness throughout except the bell end, which shall have a thickness of not less than three-fourths ( $\frac{3}{4}$ ) of the wall thickness at a point one-quarter inch from the end of the bell.

It shall be cast in sections, the length of which shall be as herein specified or shown on plans. When no particular length is specified, the pipes shall be manufactured in standard lengths of not less than four (4) feet, nor more than six (6) feet. The smallest inside diameter shall govern in deciding the sizes of any given pipe. ~~three (3)~~

The bell end shall be so constructed that the spigot end will enter to full depth. The distance the spigot end must enter freely shall be as follows: 12- to 18-inch pipe, not less than two and one-half ( $2\frac{1}{2}$ ) inches; 18- to 30-inch pipe, not less than three (3) inches; and 30- to 72-inch pipe, not less than three and one-half ( $3\frac{1}{2}$ ) inches.

The surface of all pipe, both interior and exterior, shall be smooth and even, of uniform texture, free from surface checks, cracks, blisters, fractures, laminations, lean and porous spots. The pipe shall be true to dimensions intended in the design with a permissible variation from the true form of not more than one and one-half per cent. The shell of the pipe may be thicker than called for in the designs, but it shall not be less than the designated shell thickness by more than five per cent.

Concrete pipe shall be prepared from a concrete mortar having the following composition:

Portland Cement .....	1 Part, by volume.
Fine Aggregate .....	2 Parts, by volume.
Coarse Aggregate .....	3 Parts, by volume.

and sufficient reinforcing metal to meet the requirements given below.

The Portland cement shall meet the A. S. T. M. specifications. The fine aggregate shall comply as to quality to the requirements of Section 62 and when tested by means of laboratory screens and sieves shall conform to the following requirements:

PASSING —	Retained on —	Minimum.	Maximum.
$\frac{1}{2}$ " screen . . . . .	$\frac{1}{4}$ " screen . . . . .	—	1.0%
$\frac{1}{4}$ " screen . . . . .	10 Mesh Sieve . . . . .	5.0%	25.0%
10 Mesh Sieve . . . . .	30 Mesh Sieve . . . . .	30.0%	60.0%
30 Mesh Sieve . . . . .	50 Mesh Sieve . . . . .	20.0%	40.0%
50 Mesh Sieve . . . . .	200 Mesh Sieve . . . . .	5.0%	15.0%
200 Mesh Sieve . . . . .		—	5.0%

Mortar composed of one (1) part by volume of Portland cement and two (2) parts by volume of the prescribed fine aggregate shall have a tensile strength and compressive strength at the end of seven (7) and twenty-eight (28) days equal to or greater than that of a mortar prepared in the same manner, of the same proportions and consistency, using the same cement and standard Ottawa sand.

The coarse aggregate shall comply as to quality to the requirements of Section 63 and when tested by means of laboratory screens and sieves shall conform to the following requirements:

TOTAL PER CENT PASSING.	
Laboratory Screens.	Sieves.
1 $\frac{1}{4}$ inch 100	$\frac{3}{4}$ inch 95-100
	$\frac{1}{4}$ inch 25-75
	10 mesh 0-5

The reinforcing metal shall be woven wire mesh, expanded metal, rods, hoops, or spirals manufactured from billet steel which complies with the requirements specified therefor by the A. S. T. M., Serial Designation A15-14. It must be free from grease, dirt, rust, or any foreign material that will prevent the concrete from properly adhering thereto.

Concrete pipe shall be prepared from the materials above specified. Each length shall be cast in a single operation. The moulds must be properly assembled, cleaned and oiled when so ordered before any concrete mortar is placed therein. The reinforcing metal must be so held in the required position that it will not be displaced during the manufacture of the pipe. For cast pipe the forms shall not be removed until the concrete is at least twelve (12) hours old, and after removal unless steam cured, the pipe must be covered and be kept wet at least ten (10) days. Pipe manufactured when the atmospheric temperature may drop below 35° Fahrenheit must be so protected that the concrete therein will not at any time have a temperature below 35° Fahrenheit, until the concrete is at least seven (7) days old. Pipe shall not be shipped for use that is less than twenty-eight (28) days old.

All pipe shall be reinforced as herein specified. Pipe under thirty (30) inches in diameter shall have a single line of reinforcement, thirty (30) inches and above, two lines of reinforcements as shown in the table below or an approved method of reinforcement developing equivalent strength.

Single lines of reinforcement shall be placed at equal distances from the inside and outside surfaces of the pipe.

Double lines of reinforcement shall be placed parallel to each other and one (1) inch from the inside and outside surface walls of the pipe, other requirements to be as above defined for single line reinforcements.

Longitudinal reinforcement shall extend full length of each section, and shall be wired or otherwise securely fastened to the body and bell.

Circular reinforcement shall extend completely around the pipe and have adjacent ends lap not less than forty (40) diameters of the circular reinforcement and be firmly fastened together.

The diameter and placing of the reinforcing members shall be such that there shall be at least one-half ( $\frac{1}{2}$ ) inch of concrete outside of the reinforcement.

The thickness of the pipe walls and total cross-sectional area of circular and longitudinal reinforcement for the different sizes of the pipe shall be not less than those shown in the table given below:

DIAMETER OF PIPE.	CAST PIPE.		MACHINE-MADE PIPE.		LONGITUDINAL REINFORCING.	
	Shell Thickness.	Minimum Area of Circular Reinforcing Per Foot of Pipe.	Shell Thickness.	Minimum Area of Circular Reinforcing Per Foot of Pipe.	Minimum Number of Longitudes.	Minimum Total Area, Longitudes.
12"	2"	.070	1 $\frac{1}{2}$ "	.093	4	.196
15"	2 $\frac{1}{4}$ "	.096	1 $\frac{3}{4}$ "	.123	4	.196
18"	2 $\frac{3}{4}$ "	.123	2"	.160	4	.196
24"	3"	.180	2 $\frac{1}{4}$ "	.220	4	.196
30"	3 $\frac{1}{4}$ "	2 x .167	3"	2 x .210	8	.392
36"	4"	2 x .200	2"	2 x .300	8	.614
42"	4 $\frac{1}{2}$ "	2 x .230	2 $\frac{1}{2}$ "	2 x .320	8	.614
48"	5"	2 x .265	4"	2 x .350	8	1.200
54"	5 $\frac{1}{4}$ "	2 x .300	4 $\frac{1}{2}$ "	2 x .390	12	1.326
60"	6"	2 x .330	5"	2 x .410	12	1.326

When supported at the bottom upon a knife edge one (1) inch in width, or upon two rounded bearings centered two (2) inches apart, in such manner that an even bearing is provided throughout the whole length exclusive of the bell, and load is applied at the crown through a similar knife edge, all pipe twenty-four (24) inches in diameter and greater shall withstand, without the appearance of a visible crack extending through the entire length of the pipe, a load of 1,000 D pounds per lineal foot of laying length; all pipe of a diameter less than twenty-four inches when tested in a similar manner shall withstand a load of 1,330 pounds as specified for larger size pipe. When tested to destruction, all pipe of twenty-four (24) inches diameter and greater shall show an ultimate strength of not less than 1,500 D pounds per lineal foot of laying length; all pipe of a diameter less than twenty-four (24) inches shall, in a similar manner, show an ultimate strength of not less than 2,000 D pounds per lineal foot of laying length. In the above expression of load D is the inside diameter of the pipe in feet.

The maximum average absorption as obtained by the A. S. T. M. standard boiling test shall not exceed eight (8) per cent by weight.

Each manufacturer furnishing pipe under these specifications shall be fully equipped to carry out the tests herein designated. Upon the demand of the Department and under its supervision, the manufacturer shall perform such number of tests as the Department may deem necessary to establish the quality of the pipe offered for its use. Failure of any size of pipe to meet the test requirements shall be sufficient cause for rejection of all pipes of that size, which the test specimen represents.

All pipes shall be subject to inspection at the factory, or point of delivery, by a competent inspector employed by the Department. The purposes of the inspection shall be to cull and reject pipes which, independent of the physical test herein specified, fail to meet the requirements of these specifications and rejection through inspection may be made on account of any of the following:

- (a) Porous spots on either inside or outside surface of pipe having an area of more than ten (10) square inches and a depth of more than one-half inch.
- (b) Pipe which has been patched to repair porous spots, cracks or other defects.
- (c) Variations in any dimension exceeding the permissible variations.
- (d) Fractures or cracks passing through the body or bell, except that a single crack at either end of pipe not exceeding three inches in length or a single fracture in the bell not exceeding two inches in depth nor extending more than 10 per cent around the circumference of the bell will not be considered cause for rejection.
- (e) Failure to give a clear ringing sound when tapped with a light hammer.
- (f) Exposure of the reinforcement when such exposure would indicate that the reinforcement was misplaced.
- (g) In machine-made pipe the entire absence from the exterior surface of a pipe of the characteristic water marks due to suction caused by the removal of the outer form, shall be considered proof of an insufficient quantity of mixing water and shall be sufficient cause for rejection of such pipe.

**Section 110. CONSTRUCTION METHODS.** All pipe shall be laid true to the lines and grades furnished by the Engineer. Each section of pipe shall have a full firm bearing throughout its length.

Nothing but selected fine material, free from large stones, shall be placed around and under the pipe, and all material placed under and about the pipe shall be thoroughly tamped in place by a thin iron tamping bar. Joints of cast iron, reinforced concrete, vitrified, and cement concrete sewer pipe shall be formed by caulking into the bell a gasket of jute or oakum and then filled with mortar composed of equal parts of Portland cement and clean sharp sand. In the case of concrete pipe the joints shall be thoroughly wet before making the mortar joint.

The ends of pipe culverts shall be protected by concrete walls.

Any pipe showing settlement after laying, or which is not in true alignment, before final acceptance, shall be taken up and relaid by the Contractor at his own expense.

**Section 111. BASIS OF PAYMENT.** All pipe culverts shall be paid for at the contract unit price per lineal foot, complete in place, which price shall include the furnishing of all materials, laying the pipe, all excavation (except ledge), and backfilling, and all incidental work except the masonry ends; provided, however, that, when the depth of the trench exceeds five (5) feet, all excavation necessary below five feet shall be paid for by the cubic yard at the regular contract price for roadway earth excavation. No allowance will be made for pumps, pumping or bailing, or for any materials, equipment, or labor necessary on account of water or unstable material.

#### Side Drains.

**Section 112. DESCRIPTION.** Side drains shall consist of vitrified clay pipe, laid in a trench with open joints, on a course of broken stone or screened gravel and with the trench filled with broken stone or screened gravel about and over the pipe to the proposed surface of the shoulder of the road.

**Section 113. MATERIALS.** The vitrified clay pipe shall conform to the requirements of Section 109.

The broken stone or gravel stone used shall consist of clean, durable crushed rock, free from soft, thin, elongated or laminated pieces, disintegrated stone, vegetable or other deleterious matter.

**Section 114. CONSTRUCTION METHODS.** The drain trench shall be excavated to the widths and depths given below and shall be excavated only as fast as the drain can be finished. The depth shall be that below the proposed finished surface of the shoulder of the road.

Size of Pipe, Inches.	Width, Inches.	Depth, Inches.
5	24	42
10	30	45
12	32	46
15	35	48

On the bottom of this trench shall be placed three (3) inches of broken or gravel stone, which will pass through a one and one-quarter ( $1\frac{1}{4}$ ) inch mesh, and not through a half ( $\frac{1}{2}$ ) inch mesh, hereinafter designated as No. 2.

On this material shall be laid salt-glazed vitrified clay pipe (of the size required by the Engineer) with bell and spigot joints, unless otherwise ordered, with open joints and the bell ends towards the rising grade.

All pipe must be laid true to a line and grade, and no pipe is to be laid on a grade of less than three (3) inches in one hundred (100) feet.

No. 2 broken or gravel stone shall be filled about the pipe and over it for a depth of six (6) inches. This must be carefully tamped about and rammed over the pipe. The trench shall then be filled to within six (6) inches of the surface with broken or gravel stone varying from one and one-quarter ( $1\frac{1}{4}$ ) inches to four (4) inches in diameter. No stone over four (4) inches in its largest dimension shall be used.

The trench shall then be filled to the surface with No. 2 stone, and the broken or gravel stone shall be thoroughly tamped. Any sand, silt or earth getting into the pipe or the interstices of the stone in the trench must be removed by the Contractor at his own cost, even if it be necessary to rebuild the drain.

Where, in the opinion of the Engineer, it is necessary to extend a drain to an outlet beyond the section needing to be drained, the pipe will be laid with cement joints, true to line and grade, and the gravel or stone in the trench omitted, the trench being backfilled with the material excavated from the same.

Where a pipe is carried through a bank the outlet must be protected by masonry, as provided in pipe culverts. All surplus excavated material shall be disposed of as directed by the Engineer.

**Section 115. BASIS OF PAYMENT.** All side drains shall be paid for at the contract unit price per lineal foot for side drains for the sizes of pipe required, complete in place, which price shall include the furnishing of all materials, including all broken or gravel stone, laying the pipe, all excavation (except ledge), backfilling, disposal of surplus material and all incidental work except the masonry ends. No allowance will be made for pumps, pumping or bailing, or for any materials, equipment, or labor necessary on account of water or unstable material.

#### Guard Rail.

**Section 116. DESCRIPTION.** Fencing used as guard rail shall be placed on edges of embankments and at such other places along the road as the Engineer may deem necessary. It shall be erected in accordance with the plan and in conformity with these specifications.

**Section 117. MATERIALS.** The posts shall be of well seasoned, straight, sound chestnut or cedar, not less than six (6) inches in diameter.

At culverts, when directed by the Engineer, square iron posts, one and one-quarter ( $1\frac{1}{4}$ ) inches square, shall be used.

The top rails shall be four (4) inches square and the side rails of two by six (2 x 6) inch well seasoned, straight-grained spruce, or other wood satisfactory to the Engineer, planed, free from loose or unsound knots.

The oil preservative to be used for posts, etc., shall be a distillate of coal-gas tar, or coke-oven tar. It shall meet, according to the A. S. T. M. Methods, with the following requirements:

- (a) *Water Content.* The oil shall contain not more than 2 per cent water by volume.
- (b) *Specific Gravity.* The specific gravity of the oil shall be not less than 1.08 at 38° C./15.5° C.
- (c) *Distillation.* The distillates based on a dry oil shall meet the following requirements by weight:

Up to 210° C., not more than 1.0 per cent.

Up to 235° C., not more than 10.0 per cent.

The residue above 355° C., if it exceeds 5 per cent, shall have a float test of not more than 50 seconds at 70° C.

The specific gravity of the fraction between 235° C. and 315° C. shall be not less than 1.03 at 38° C./15.5° C.

The specific gravity of the fraction between 315° C. and 355° C. shall be not less than 1.10 at 38° C./15.5° C.

(d) *Flashing Point.* The flash point shall be not less than 100° C.

(e) *Solubility.* It shall contain not more than 0.5 per cent of matter insoluble in benzol.

(f) *Coke Residue.* The oil shall yield not more than 2 per cent of coke residue.

**Section 118. CONSTRUCTION METHODS.** The posts shall be spaced eight (8) feet apart on centers, the bottom of each post to be sawed off square and set plumb on the lines and to the grades given by the Engineer.

The posts shall be set three (3) feet into the ground and three and one-half ( $3\frac{1}{2}$ ) feet above the ground, and the backfilling thoroughly tamped.

All bark shall be removed before setting, all knots hewn down to face and the exposed surfaces shaved.

Both top and side rail shall be notched into and securely fastened to the posts, as shown on the plan, and be long enough to extend over three (3) posts and break joints; all joints shall be directly over posts.

Where iron posts are used the side rails shall be bolted to the iron posts with two bolts set in holes drilled through each post.

The posts are to be thoroughly covered with two coats of preservative (hereinbefore described) from the bottom of the posts to a point six (6) inches above the finished surface of the road.

All parts of the exposed surface of the guard rail shall be painted with one coat of white lead and linseed oil.

**Section 119. BASIS OF PAYMENT.** All guard rail shall be paid for at the contract unit price per lineal foot, complete in place, which price shall include all materials, tools, painting, post preserving, all excavation for posts (except ledge), and all other incidental work.

#### Guard Stones.

**Section 120. DESCRIPTION.** Boulders or ledge stones used as guard stones shall be placed on edges of embankments and at such other places along the road as the Engineer may deem necessary.

**Section 121. MATERIALS.** The guard stones shall consist of boulders or ledge stone, sound and durable, not less than three and one-half ( $3\frac{1}{2}$ ) feet, nor more than five (5) feet in their longest dimensions, not less than twelve (12) inches in thickness and not less than two (2) feet in width.

**Section 122. CONSTRUCTION METHODS.** The stones shall be set twelve (12) inches into the ground, and that portion of the stone nearest the roadway shall be not less than three (3) feet from the hardened surface. The stones shall be not more than four (4) feet apart at their nearest points.

All stones shall be so placed as to present a distance above the ground as nearly uniform as possible and not less than two and one-half (2½) feet, with their least dimension of thickness at right angles to the side line of hardened surface.

**Section 123. BASIS OF PAYMENT.** Guard stones shall be paid for at the contract unit price per lineal foot measured in place (such measurement to include space between the stones as well as that occupied by them), longitudinally with the road. The price to be paid shall include the stones furnished and set in place, including all excavation (except ledge), all removal of excavated material, and including all incidental work.

#### Stock Fence.

**Section 124. DESCRIPTION.** Stock fences shall be built at such places as the Engineer may deem necessary. They shall be erected in accordance with the plan and in conformity with these specifications.

**Section 125. MATERIALS.** The posts shall be of well seasoned, straight, sound chestnut or cedar, not less than four (4) inches in diameter. The wire shall consist of No. 12 two-strand twisted.

**Section 126. CONSTRUCTION METHODS.** The posts shall be spaced twelve (12) feet apart on centers, the bottom of each post to be sawed off square and set plumb on the lines and to the grades given by the Engineer. The posts shall be set not less than three (3) feet into the ground and five (5) feet above the ground, and the backfilling thoroughly tamped. All bark shall be removed before setting and all exposed surfaces shaved.

Upon the posts so set shall be strung and drawn taut four (4) lines of No. 12 two-strand twisted wire, spaced fifteen (15) inches apart on centers, each line of wire to be securely fastened to the posts with two (2) inch staples, the top line of wire to be placed not more than two (2) inches from the top of the posts, all ends of the wire to be fastened to the posts with at least three (3) staples and in such a manner as to leave no loose ends.

**Section 127. BASIS OF PAYMENT.** All stock fence shall be paid for at the contract unit price per lineal foot, complete in place, which price shall include all materials, tools, all excavation for posts (except ledge), and all other incidental work.

#### Timber Piles.

**Section 128. DESCRIPTION.** Timber piles shall be placed in accordance with the dimensions and elevations required or indicated on the plans and in conformity with these specifications, as directed by the Engineer.

**Section 129. MATERIALS.** The Contractor shall be responsible for determining the length of piles required, either by driving test piles or otherwise. The piles shall be of new spruce, oak, chestnut or yellow pine, sound and straight and free from all defects that will, in the opinion of the Engineer, impair their strength or usefulness for the purpose intended. Piles shall be cut above the ground swell and have a uniform taper, and shall be free from short kinks. A line drawn from the center of the butt to the center of the tip shall lie wholly within the body of the pile. All knots shall be trimmed close to the body of the pile. Piles shall be not less than ten (10) inches in diameter at the butt and not less than six (6) inches in diameter at the small end, under the bark in both cases, and they shall be of sufficient length to permit cutting off at the proper grade after driving. Piling shall be subject to inspection before or after shipment, at the option of the Engineer, and the right is reserved to reject all piles that do not fulfill the requirements.

**Section 130. CONSTRUCTION METHODS.** No piles shall be driven until after the excavation is completed. Piles shall be carefully driven and to the satisfaction of the Engineer, and they shall be cut off at the proper grade. Any pile which may be driven in the wrong position or which may be too short after driving, or which may be split in driving, or whose point or butt is broomed or battered, shall be withdrawn and another pile substituted. All removal and replacement of piles shall be done at the expense of the Contractor. All piles shall be driven vertically or battered as required and shall be accurately spaced and in true alignment. The necessary length of piles for various parts of the work and the safe load that can be placed on the same may be ascertained by driving test piles in a number of different places where the piles are to be used, as directed by the Engineer. Such test piles shall be removed in case they are in a position as not to be available for use in the structure. Piles shall be driven with a pile driver of construction approved by the Engineer, the hammer weighing not less than two thousand pounds, unless by special approval of the Engineer. The driving of piles with followers or the splicing of piles shall be avoided if practicable. When followers are used, at least one pile in every group shall be a long pile driven without a follower. Splicing of piles shall only be done under a special permission given by the Engineer. When it is necessary to splice piles, an approved splice shall be used and also dowels one (1) inch in diameter extending eight (8) inches into each pile shall be used. Water jets may be used, either alone or in combination with a hammer. If water jets and a hammer are used for driving, the jets shall be withdrawn and the piles shall be driven by the hammer to secure the final penetration.

When required, the actual length and number of piles to be used shall be determined by actual loading tests, the safe allowable loads determined from such tests shall be considered as 50 per cent of that load, which after 48 hours' application causes a permanent settlement. In the absence of loading tests, the safe bearing values for timber piles shall be determined by the following formulas:

$$P = \frac{2WH}{S + 1.0} \text{ for gravity hammers}$$

$$P = \frac{2WH}{S + 0.1} \text{ for single-acting steam hammers}$$

$$P = \frac{2H(W+Ap)}{S + 0.1} \text{ for double-acting steam hammers}$$

where  $P$  = safe bearing power in pounds,  $W$  = weight in pounds of striking parts of hammer,  $H$  = height of fall in feet,  $A$  = area of piston in square inches,  $p$  = steam pressure in pounds per square inch,  $S$  = average penetration in inches per blow for the last five to ten blows for gravity hammers and the last ten to twenty blows for steam hammers.

The above formulas are only applicable when (a) the hammer has a free fall, (b) the head of the pile is free from crushed or broomed fiber, (c) the penetration is at a reasonably quick and uniform rate, (d) there is no sensible bounce. Twice the height of the bounce shall be deducted from  $H$  to determine its true value. The bearing power shall be not less than thirteen (13) tons nor more than twenty (20) tons and shall be less than the crushing strength of the pile.

Unless otherwise directed, all piles shall be sharpened before driving and if considered necessary, in the opinion of the Engineer, iron shoes of approved design shall be used. All piles shall have their butt ends bound with wrought iron rings during driving. The splicing of piles shall be avoided.

**Section 131. BASIS OF PAYMENT.** This work shall be paid for at the contract unit price per lineal foot for "Timber Piles," complete in place, which price shall include all materials, equipment, tools, labor and work incidental thereto. Payment shall be made for the actual number of feet of piles left in place and no allowance shall be made for the amount of cut-off, or for any piles not driven in accordance with these specifications.

Test piles when driven so as to be available for use in the structure shall be paid for as hereinbefore provided for "Timber Piles."

#### **Lumber Sheeting for Foundations.**

**Section 132. DESCRIPTION.** Sheeting shall be furnished and placed for foundations, when required, in the opinion of the Engineer, in accordance with these specifications.

**Section 133. MATERIALS.** The sheeting shall be sound spruce or pine plank not less than three (3) inches thick, planed one side and either tongued and grooved or splined. The thickness of the sheeting shall be increased if ordered by the Engineer. The Contractor shall furnish wales and bracing to maintain the sheeting in place and support the excavation.

**Section 134. CONSTRUCTION METHODS.** The sheeting shall be driven to firm soil below the base of the footing course of the wall and after completion of the wall shall be cut off at the natural level of the ground or as the Engineer may direct, leaving the lower portion of the sheeting in place.

**Section 135. BASIS OF PAYMENT.** The sheeting left in place by order of the Engineer shall be paid for at the contract unit price per M. ft. B. M. for lumber sheeting left in place, the measurements upon which payment is based to be only of the lumber ordered to be left in place, and the price paid shall include all materials, all driving, cutting, removing, all equipment, tools, labor and work incidental thereto.

#### **Riprap.**

**Section 136. DESCRIPTION.** Riprap shall be composed of approved stone placed on banks to protect them from slipping or washing at places indicated on the plans, or where directed, in accordance with these specifications.

**Section 137. MATERIALS.** The stone shall be sound, free from structural defects and of approved quality, angular in shape and not less than one (1) foot in their smallest dimension.

**Section 138. CONSTRUCTION METHODS.** The stone shall be roughly placed on the banks where and as directed by the Engineer to a slope not steeper than one to one.

**Section 139. BASIS OF PAYMENT.** This work shall be paid for at the contract unit price per cubic yard for "Riprap," complete in place, which price shall include all materials, equipment, tools, labor and work incidental thereto.

#### **Concrete Curbstone with Curb Bar.**

**Section 140. DESCRIPTION.** Concrete curbstone shall be set to the required line and grade on a bed of gravel and in accordance with these specifications. The concrete shall be composed of one (1) part of Portland cement, two (2) parts of sand and four (4) parts of broken stone or screened gravel.

The curbstone shall be twenty-four (24) inches in depth, six (6) inches in width at the top, and seven (7) inches in width at the bottom.

The upper edge of the face of the curbstone shall be protected with a galvanized steel curb bar.

**Section 141. MATERIALS.** The cement, water, sand and broken stone or screened gravel stone shall conform to the requirements of sections 60, 61, 62 and 63 respectively, excepting that the size of the stone shall vary from one-half ( $\frac{1}{2}$ ) to one and one-quarter ( $\frac{3}{4}$ ) inches in their largest dimensions.

The curb bar shall be made of steel of good quality and galvanized and shall be of a type satisfactory to the Engineer.

**Section 142. CONSTRUCTION METHODS.** The trench for the curbstone is to be eighteen (18) inches wide, and its sub-grade is to be twenty-eight (28) inches below the top of the finished curbstone.

Upon this sub-grade good, clean, coarse gravel shall be placed and thoroughly tamped so that it will be four (4) inches in depth after tamping.

Curbing shall be moulded in place in sections six (6) feet long and provision made at each joint for expansion of one-sixteenth ( $\frac{1}{16}$ ) inch.

The curb bar shall be placed to the satisfaction of the Engineer immediately following the placing of the concrete, in the upper edge of the face of the curbing.

The concrete shall be of such consistency and be so spaded and worked that a smooth mortar face will be produced.

All forms shall be set true to line and grade and held rigidly in position. They shall be either of metal or of acceptable planed and matched lumber, and of such construction that a smooth surface will be provided.

The forms shall be left in place until the concrete has set sufficiently so that, in the opinion of the Engineer, they can be removed without injury to the curbing. The curbing shall immediately upon the removal of the forms be rubbed down to a smooth and uniform surface, but no plastering will be allowed. For this work a competent and skillful finisher shall be employed.

The Contractor shall protect the curbing and keep it in first-class condition until the completion of the contract. Any curbing which is damaged at any time previous to the final acceptance of the work shall be removed and replaced with satisfactory curbing at the Contractor's expense.

After the forms have been removed, the trench shall be backfilled with gravel to the depth ordered by the Engineer and thoroughly tamped, care being taken not to affect the line or grade of the stone.

**Section 143. BASIS OF PAYMENT.** This work shall be paid for at the contract unit price per lineal foot for concrete curbstone with curb bar, complete in place, which price shall include all materials (except gravel used for foundation and back-filling), all excavation (except ledge), and including all work incidental thereto.

The gravel used for foundation and backfilling shall be paid for at the contract price per cubic yard for gravel borrow.

#### **Stone Curbing.**

**Section 144. DESCRIPTION.** Stone curbing shall be set to the required line and grade on a bed of gravel and in accordance with these specifications.

**Section 145. MATERIALS.** All stone curbing shall be hard and durable, free from seams or other imperfections, all of the same color, and is to be cut in lengths of not less than six (6) feet, to be free from bunches and depressions, and to have

horizontal beds; the ends to the entire depth to be squared with the top and so cut as to be set with joints of not more than three-eighths ( $\frac{3}{8}$ ) of an inch without mortar; the curbing is to be out of wind; the hammered surfaces are to be full to line.

The stone curbing is to be seven (7) inches wide on top and not less than eighteen (18) inches deep; it is to be hammered on top, fine pointed three (3) inches down on the back, squared with the top and fine pointed ten (10) inches down on the face, the remainder of the face is to be straight split. The face is to be cut square with the top.

The cement, water and sand shall conform to the requirements of Sections 60, 61 and 62 respectively.

The gravel shall conform to the requirements of Section 14.

**Section 146. CONSTRUCTION METHODS.** The stone curbing shall be placed to the required line and grade on a gravel foundation in a trench.

The trench for the stone curbing is to be eighteen (18) inches wide and its sub-grade is to be twenty-two (22) inches below the top of the finished stone curbing.

Upon this sub-grade a foundation is to be made, consisting of good, clean, coarse gravel, thoroughly rammed so that it will be four (4) inches thick when completed; upon this foundation other gravel of the same kind is to be spread, the stone curbing laid therein, the joints made as close as possible, and all the spaces under the stone curbing thoroughly filled with gravel and tamped so that the stone curbing bear throughout its whole length and be at the line and grade required.

The joints between the stone curbing shall be carefully pointed top, front and back, with mortar made of equal parts of Portland cement and clean sharp sand. The trench shall be backfilled with gravel to the depth ordered by the Engineer and thoroughly tamped, care being taken not to affect the line or grade of the stone curbing.

**Section 147. BASIS OF PAYMENT.** This work shall be paid for at the contract unit price per lineal foot for Stone Curbing, complete in place, which price shall include all materials (except gravel used for foundation and backfilling), all excavation (except ledge), and including all work incidental thereto.

The gravel used for foundation and backfilling shall be paid for at the contract unit price per cubic yard for gravel borrow.

#### **Date and Seal for Bridges.**

**Section 148.** The Contractor shall place the date and seal on bridges as indicated on the plans without additional charge. The seal shall be placed only on bridges of 20 feet span and over. The seal and a blue print of the date will be furnished by the party of the first part.

#### **Zinc Plates for Bridges.**

**Section 149.** Rolled zinc plates one-quarter ( $\frac{1}{4}$ ) inch thick shall be placed under beams, and at other places, as shown on plans, two plates being placed at each bearing.

This work shall be paid for at the contract unit price per pound for Zinc Plates, complete in place, which price shall include all materials, equipment, labor, tools and work incidental thereto.

## TOWN LINE POST REMOVED AND RESET

Section ~~150~~ Description. The present Town line post shall be removed and reset as directed by the Engineer.

Section ~~151~~ Materials. The post to be removed and reset shall consist of the present Town line post.

Section ~~152~~ Construction Methods. The present Town line post shall be carefully removed and reset in a new location as directed by the Engineer. The hole caused by the removal of the post shall be backfilled with suitable material and carefully tamped. The post shall be reset at such depth and position as the Engineer directs, and the backfilling shall be carefully tamped.

When the excavation is in spongy earth, gravel or sand must be furnished by the contractor, placed about the post and thoroughly tamped. The contractor will be held responsible for the post and he must replace it at his own expense if it becomes broken by his employees or otherwise.

Section ~~153~~ Basis of Payment. This work will be paid for at the contract unit price each for town line posts removed and reset complete in place, which price shall include all labor, tools, and materials, all excavation (except ledge), backfilling, tamping, disposal of surplus material and all other incidental work.

## REMOVAL AND RELAYING PIPE CULVERTS

Section 54 Description. The present pipes shall be removed and relaid on a new location where directed by the Engineer, and on a firm bed in accordance with these specifications.

Section 55 Materials. The pipes to be relaid shall consist of the present pipes of the kind specified in the Proposal.

Section 56 Construction Methods. The pipe shall be relaid true to the lines and grades furnished by the Engineer. Each section of pipe shall have a full firm bearing throughout its length.

Nothing but selected fine material, free from large stones, shall be placed around and under the pipe, and all material placed under and about the pipe shall be thoroughly tamped in place by a thin iron tamping bar. Joints of cast iron, reinforced concrete, vitrified clay and cement concrete sewer pipe shall be formed by caulking into the bell a gasket of jute or oakum and then filled with mortar composed of equal parts of Portland cement and clean sharp sand. In case of concrete pipe the joints shall be thoroughly wet before making the mortar joint. In the case of corrugated iron pipe culverts, the Contractor shall furnish and place new collars and bolts. All pipe showing settlement after laying or which is not in true alignment, before final acceptance, shall be taken up and relaid by the Contractor at his own expense.

Section 57 Basis of Payment. All pipe culverts relaid will be paid for at the contract unit price per lineal foot of the kind specified removed and relaid in place, which price will include the furnishing of all materials, removing and relaying the pipe, all excavation (except ledge), backfilling, and all incidental work except the masonry ends, provided, however, that when the depth of the trench exceeds five (5) feet, all excavation necessary below five feet will be paid for by the cubic yard at the regular contract price for roadway earth excavation.

# ADDENDA, 1926

The following Articles, Sections or paragraphs shall supersede, or become a part of corresponding Articles Sections, or paragraphs of the foregoing printed specifications.

*Article XXI A. Preference in Employment of Labor.*

In the employment of labor, in the performance of this contract, preference shall be given, other conditions being equal, to honorably discharged soldiers, sailors, and marines, but no other preference or discrimination among citizens of the United States shall be made. (Section 6 of the Act of Congress approved February 28, 1919, entitled "An Act making appropriations for the service of the Post Office Department for the fiscal year ending June 30, 1920, and for other purposes" Public No. 299, 65th Congress). This article shall be substituted for the first paragraph of Article XXI.

*Article XXXIII A.*

This work shall be done under the direct supervision and to the complete satisfaction of the Department, subject to inspection at all times and approval by the United States Secretary of Agriculture, or his agents, and in accordance with the laws of the State of Massachusetts and the rules and regulations of said Secretary of Agriculture made pursuant to that certain act of Congress approved July 11, 1916 (39 U. S. Statutes at Large, 335), entitled "An Act to provide that the United States shall aid the States in the construction of rural post roads, and for other purposes."

*Section 4 A. Ledge.*

Ledge excavation for structures shall also include the removal of concrete and brick masonry not in bridges.

*Section 8. Overhaul.*

No overhaul allowance will be made on borrow of any kind.

*Section 9. Sub-grade.*

The plane of the bottom of the excavation and the top of the fill when completed shall be known as the sub-grade, and shall be true to the lines, grades and cross-sections given.

All clay and spongy material in the road-bed shall be removed to a depth to be determined by the Engineer, and the space thus made shall be filled with such material as the Engineer may direct.

Before surfacing or sub-base is spread, the sub-grade shall be shaped to a true surface conforming to the proposed cross-section of the highway and rolled by a steam or other self-propelled roller, weighing not less than ten (10) tons.

All depressions occurring must be filled with suitable material and again rolled until the surface of the sub-grade is smooth and hard.

Any portion of the sub-grade which is not accessible to a roller shall be compacted thoroughly with hand tampers weighing not less than fifty (50) pounds, the face of which shall not exceed a hundred (100) square inches in area.

The cost of shaping and rolling the sub-grade will be included in the price paid for excavation and for furnishing the material used, and shall not be additional thereto.

Steam rollers, steam boilers and steam shovels shall be equipped with spark arresters.

*Section 12 A. Basis of Payments. (a) Roadway Excavation.*

All "roadway excavation," including excavation of all intersecting roadways, driveways, approaches, ditches, and culverts, except pipe culverts, which is composed of all material except ledge, will be paid for at the contract unit price per cubic yard for roadway earth excavation. These prices shall include all clearing and grubbing (except as may be otherwise provided herein), all excavation within the limits of the work contracted for, formation of embankments, disposal of surplus material, preparation of subgrade and shoulders, finishing of slopes, and the furnishing of all equipment, tools, labor and work incidental thereto.

*(d) Borrow.*

All borrow will be paid for at the contract unit price per cubic yard for borrow, of the kind specified, which price shall include furnishing and placing the material, finishing the slopes, and all equipment, tools, labor and work incidental thereto.

*Section 14 A. Sub-base. Materials.*

Where sub-base consists of stone and gravel, it shall be as specified under Sections 13 to 16, except that when the depth of the sub-base is eight (8) inches, the stones shall not exceed ten (10) inches in their longest dimension, and about fifty (50) per cent of the stone shall be five (5) inches or more in its longest dimension.

*Section 15 A. Sub-base. Construction Methods.*

To the third paragraph of Section 15, page 10, shall be added the following: Sledges shall be used to break up the larger or projecting stones, and such stones that cannot be so broken up shall be removed and the remaining space filled with smaller stones and the rolling continued.

### *Bleeders.*

Bleeders shall be constructed where, of such materials, and as directed by the Engineer.

The excavation for bleeders will be considered and paid for as roadway earth excavation.

The material used for filling the trenches of the bleeders may consist, as directed by the Engineer, of stone filling, screened gravel stones, or broken stone, and covered with suitable gravel or other material about 6 inches thick or brought to the surface and sealed with bitumen as the Engineer may direct. When the material used in the bleeders consists of stone filling or screened gravel stones it will be paid for at the contract unit price per cubic yard for stone filling. If it consists of broken stone it will be paid for at the contract price per ton for broken stone. If covered with gravel or other material, such material will be paid for at the contract unit price for the material used. If brought to the surface and sealed with bitumen, the bitumen will be paid for at the contract unit price for bitumen.

### *Section 30 A. Broken Stone for Base Course.*

The broken stone for the base course shall consist of clean, durable, crushed rock having a French coefficient of wear of not less than ten (10) and a toughness not less than eight (8), and shall consist of No. 1, or No. 1 and No. 2 stone. Where both No. 1 and No. 2 stone are used in the base course, not more than 40% shall be No. 2 stone.

### *Section 34 A. Broken Stone for Bituminous Macadam Surface Course.*

The broken stone for the surface course shall consist of clean crushed rock having a French coefficient of wear and a toughness as specified in the Special Provisions. The stone shall be thoroughly screened, uniformly graded in size and quality, angular and free from rounded surfaces, and no flat, elongated or otherwise objectionable stone shall be used.

### *Section 35 A. Bituminous Macadam Surface Course. Construction Methods.*

The seventh paragraph of Section 35, page 12, shall be changed to read as follows: "Bituminous material when applied to the upper course of stone shall have a temperature of not less than 300° F. and not more than 350° F. for asphalt, and not less than 200° F. and not more than 275° F. for tar."

### *Section 39 A. Bituminous Concrete Surfacing Types A. and B. Construction Methods.*

The fourteenth paragraph of Section 39 and 43, pages 14 and 15, shall be changed to read as follows: "The asphaltic oil when applied to the road surface shall have a temperature approximating 225° F."

### *Measurement of Bituminous Material.*

For the purpose of measurement, a gallon shall be a volume of 231 cubic inches and measurement shall be based on the volume of the bituminous material at its temperature when applied.

### *Section 53 A.*

In place of Hydrated Lime, as specified under Sections 53 and 54 B, Diatomaceous Earth in the proportion of 3% (by weight) of the cement content may be used, and its grade shall be equal in quality to that commercially known as Celite.

### *Section 54 A and 60 A. Portland Cement.*

All cements for this work shall be from at least seven (7) day bin-tested stock.

### *Section 54 A (f) — Transverse Joint Filler.*

The transverse joint filler shall consist either of a moulded asphaltic paving strip, an asphaltic mastic or an asphaltic cement filler.

Moulded joint fillers shall be prepared by impregnating such inert materials as felt, woolen or cotton fiber, paper pulp, sawdust, etc., with an asphaltic cement complying with the requirements given below. The inert material may be applied as a layer on the outside of a bituminous sheet, or may be uniformly distributed through the bituminous material. In either case sufficient inert material must be used to prevent the joint from chipping during cold weather.

Moulded joint fillers shall be cast in sheets, the thickness of which shall be one-half (1/2) inch. All moulded joint fillers to be used in transverse joints in a concrete pavement shall be cast in lengths equal to the width of the slab and have a width of one inch greater than the thickness of the pavement.

The asphalt used for the fabrication of expansion joint fillers shall comply with the requirements given below:

1. Specific gravity at 25° C.....	1.00 minimum
2. Penetration at 25° C., 100 gms. for 5 sec.....	30-40
3. Penetration at 46° C., 100 gms. for 5 sec.....	79 maximum
4. Melting point (Ball & Ring).....	65° C. to 95° C.
5. Evaporation loss on 20 gms., 163° C., for 5 hrs.....	1.0% maximum
6. Solubility in Benzol C <sub>6</sub> H <sub>6</sub> .....	99.3% minimum
7. Solubility in CCL <sub>4</sub> .....	99.0% minimum
8. Flash point in degrees C.....	200 minimum
9. Ductility at 25° C. .....	4.0 cm. minimum

Asphaltic mastic filler shall consist of a mixture of from 60 to 70 per cent by weight of asphalt and from 30 to 40 per cent by weight of mineral filler.

Asphaltic Cement Filler shall consist of an asphaltic cement containing from 20 to 30 per cent of fine mineral matter naturally occurring therein, and which without the addition of any other material, shall have the characteristics described under requirements for Asphaltic Cement Filler.

The oil asphalt shall be homogeneous, free from water and shall not foam when heated to 175° C. (347° F.).

It shall meet the following requirements:

1. Specific gravity 25°/25° C. (77°/77° F.) ..... not less than 1.010
2. Flash point, not less than ..... 175° C. (347° F.)
3. Melting point ..... 40° C. (104° F.) to 60° C. (140° F.)
4. Penetration at 25° C. (77° F.), 100 gms., 5 sec. ..... 60-70
5. Loss at 163° C. (325° F.), 5 hours ..... not more than 1.0%
6. (a) Penetration of residue at 25° C. (77° F.), 100 gms., 5 sec. ..... not less than 40
6. Total bitumen (soluble in carbon disulphide) ..... not less than 99.5%
6. (a) Organic matter insoluble ..... not more than 0.2%

Material for any one contract shall not vary more than 0.020 in specific gravity, nor more than 10° C. in melting point within the test limits above specified.

The fluxed native asphalt shall be homogeneous, free from water, and shall not foam when heated to 175° C. (347° F.).

It shall meet the following requirements:

1. Specific gravity 25°/25° C. (77°/77° F.) ..... 1.050-1.070
2. Flash point not less than ..... 175° C. (347° F.)
3. Melting point ..... 45° C. (113° F.) to 55° C. (131° F.)
4. Penetration at 25° C. (77° F.), 100 gms., 5 sec. ..... 60-70
5. Loss at 163° C. (325° F.) 5 hours ..... not more than 3.0%
5. (a) Penetration of residue at 25° C. (77° F.) 100 gms., 5 sec. ..... not less than 30
6. Total bitumen (soluble in carbon disulphide) ..... not less than 94.5%
6. (a) Inorganic matter insoluble ..... 2.0-3.5%

The mineral filler shall have the following gradation:

Passing 10 mesh sieve ..... 100%  
Passing 100 mesh sieve ..... not less than 30%  
Passing 200 mesh sieve ..... not less than 20%

Where plasters or finer sand is used it will be necessary to add lime or cement for the 200 mesh content.

The Asphalt Cement Filler shall be homogeneous, free from water, and shall not foam when heated to 175° C. (347° F.).

It shall meet the following requirements:

1. Specific gravity 25°/25° C. (77°/77° F.) ..... 1.23 to 1.28
2. Flash point, open cup ..... not less than 175° C. (347° F.)
3. Melting point ..... 48° C.-55° C. (118° F.-131° F.)
4. Penetration at 25° C. (77° F.) 100 gms., 5 sec. ..... 40 to 50
5. Loss 50 gms. 163° C. (325° F.) 5 hrs. ..... not more than 3.0%
5. (a) Penetration of residue at 25° C. (77° F.), 100 gms., 5 sec. ..... not less than 2.0 mm.
6. Total bitumen (soluble in carbon disulphide) ..... 65.0 to 75.0%
6. (a) Inorganic matter insoluble ..... 20.0 to 35.0%
7. Ductility at 77° F. ..... 25 cm.

#### Section 55 A (k). Construction Methods.

Transverse joints shall conform to the requirements of Section 55 (k) and also to the following specifications:

Poured joints shall be formed by placing a temporary joint, shaped to the section of the pavement, of a type and material approved by the Engineer and one-half an inch in thickness which shall afterward be removed and the joint immediately filled by pouring the Asphaltic Mastic, or Asphaltic Cement Filler. Temporary wood joints will not be permitted. The Asphaltic Mastic or an Asphaltic Cement Filler must be uniform in composition and have a temperature of not less than 325° F. when poured into the joint. As the filler cools and subsides, additional mastic or asphaltic cement filler shall be added so that the joint will be flushed full when the filler has cooled to normal temperature. The joint opening shall be free from all foreign material, open the full depth and the faces clean and dry when the hot filler is applied.

The pouring shall be done by means of a device acceptable by the Engineer and the pouring shall be manipulated in such a manner that the material will not be spilled over the surface of the adjacent pavement, curbs or structures. Any material so spilled shall be immediately and completely removed by the Contractor without additional compensation.

#### Section 55 A. (f) Mixing Concrete:

The use of mixers having a chute delivery will not be permitted.

#### Section 55 A. (n) Protection of Concrete.

The first paragraph of Section 55 (n), page 21, shall be changed to read as follows:

"As soon as finished (except in cold weather), the concrete shall be protected by a canvas covering, suspended not less than twelve (12) inches above the surface, and if directed, the surface of the pavement shall be sprinkled with water. When the concrete has hardened sufficiently, the canvas covering shall be removed,

the entire surface of the pavement wetted thoroughly, and the entire exposed surface, both top and sides, covered with earth or other approved material to a depth of not less than two (2) inches. This material shall be kept moist by a sprinkling with water if directed, and shall remain on the concrete for a period of not less than 10 days under the most favorable conditions, or for a longer period if directed by the Engineer, during which time traffic shall be excluded from the concrete by the erection and maintenance of suitable barricades, and satisfactory precautions shall be taken to exclude foot traffic for a period of not less than three (3) days. When required or approved, other methods of curing and protecting the concrete may be used.

## CEMENT CONCRETE MASONRY

### Section 68 A. Mixing Concrete.

No mixer of less than one (1) bag capacity shall be used.

## MANHOLES AND CATCH BASINS

### Section 95 A. Basis of Payment.

The contract unit price each paid for "Catch Basins or Manholes" will be for a standard depth of six (6) feet six (6) inches, measured vertically from the top of the floor to the outside top of the grating or cover. When the depth exceeds the standard depth of six and one-half (6½) feet, additional payment will be made in the proportion of the additional depth to the standard depth.

## PIPE CULVERTS

### Section 109 A. Materials.

Vitrified clay pipe shall meet the same requirements for strength as Cement Concrete Sewer Pipe, and shall conform to the requirements of A. S. T. M. Specifications, Serial Designation C-13-24.

## SIDE DRAINS

### Section 114 A. Construction Methods.

The second line of the fifth paragraph of Section 114 shall be changed to read as follows:

"tamped about and rammed over the pipe. The trench shall then be filled to within six (6) inches of the top of the sub-base with broken or"

The first line of the sixth paragraph of Section 114 shall be changed to read as follows:

"The trench shall then be filled to the top of the sub-base with No. 2 stone, and the broken or gravel stone shall be thoroughly tamped."

### Rectangular Mesh Stock Fence.

Stock fence shall be constructed as specified under Sections 124 to 127 inclusive, except that the wire shall be not less than forty-seven (47) inch medium weight, galvanized, rectangular mesh, stock fence. There shall be not less than ten (10) horizontal bars. The top and bottom bars shall be not less than No. 10 gauge in size, and the intermediate bars not less than No. 13 gauge. The vertical stay wires shall be spaced not less than sixteen (16) to a rod and in size shall be not less than No. 13 gauge.

### Cement Brick for Catch Basins, Manholes and Leaching Basins.

Cement brick may be used instead of the brick specified under Sections 93 to 97. The cement brick shall fulfill the requirements of the Standard Specification of the American Concrete Institute, Serial Designation P-1B-25.

### Painting Guard Rail.

All parts of the exposed surface of the new guard rail shall have an application of a first and second coat of white paint to be mixed as follows:

#### First Coat:

100 lbs. of carbonate of white lead.  
25 lbs. of pure zinc oxide.  
5 gals. of raw linseed oil.  
2 qts. of turpentine or turpentine substitute.

#### Second Coat:

100 lbs. of carbonate of white lead.  
25 lbs. of pure zinc oxide.  
4 gals. of raw linseed oil.  
1 qt. of turpentine or turpentine substitute.  
1 pt. of liquid paint dryer.

All of the above paint materials shall conform to the quality called for in Specifications for Paint Materials, Commonwealth of Massachusetts, Department of Public Works, Division of Highways. The surface shall be perfectly dry and clean when the paint is applied, and the first coat of paint shall have become thoroughly dry and hard before the second application is made. The paint may be applied by hand or spray, but any method used to apply the paint must meet the approval of the Engineer.

*Guard Rail:* Guard rail shall be constructed as specified under sections 116 to 119 inclusive, except that the posts shall be spaced not less than seven and one half (7½) feet and not more than eight (8) feet apart on centres.

## Special Provisions

Supplementing the foregoing specifications with Addenda, the following clauses relate in particular to this contract. In case of conflict, these "Special Provisions" following shall take precedence and shall govern.

Article XXV A.

The road shall be kept open for all travel and shall be built one half width at a time. Stone subbase shall be rolled and filled with gravel and left in a safe condition for travel before travel is turned onto it and the end of each section shall be so sloped that travel may pass up and over without difficulty.

The Contractor shall so carry on the work that travel will not be obstructed.

Sub-base.

Where sub-base is required it shall consist of stone and gravel as specified under sections 13 to 16 inclusive and amendments in the Addenda.

Type of Surface.

The surface shall consist of a broken stone base course with a Bituminous Macadam Surface Course constructed as specified under sections 29 to 36 inclusive, and 170 to 173 inclusive, and amendments in the Addenda, except as follows:

- (a) The upper surface of the broken stone base course when thoroughly rolled shall be two and one half inches below and parallel to the proposed finished surface of the surfacing course.
- (b) The surfacing course shall be two and one half inches in depth after rolling.
- (c) The bituminous material shall consist of asphalt, and the first application as specified in section 35 shall be at the rate of two and one quarter (2-1/4) gallons per square yard.
- (d) The broken stone for the surface course shall have a French Coefficient of Wear of not less than twelve (12) and a Toughness of not less than ten (10).

Section 3 A.

The work shall include all excavation and embankment for Street Railway changes which will be paid for as specified in Section 12 (A).

The Street Railway Company will remove, relay, raise, lower, relocate and ballast the tracks and relocate and change poles and wires and this work will not be done by the Contractor and he shall so proceed with his work concurrently with the Street Railway Company under the direction of the Engineer that the changes in the tracks, poles, wires, etc., including such repairs to the tracks, where their grade and location is not changed, may be done by the Street Railway Company without interruption or delay on account of his work.

Gravel Borrow for Street Railway.

Sufficient gravel borrow shall be dumped in piles along the Street Railway tracks at such places as the Engineer directs, and spread and rolled up to the bottom of the ties where the location of the tracks is changed. The quality of this gravel borrow will be as provided under section 14. The gravel dumped in piles will be used by the Street Railway Company for doing the work of raising, ballasting and surfacing the tracks.

The gravel to be used for Street Railway work will be paid for at the contract unit price per cubic yard for gravel borrow.

All work shall be conducted under the direction of the Engineer so that the Street Railway traffic will not be interrupted and in such a way as to provide for satisfactory boarding and alighting of Street Railway passengers, and the tracks shall be kept free from excavated or other material.

Article XLII A.

The seventh and fourteenth lines of Article XLII shall be changed to read "Town Clerk" instead of "party of the first part".

## PROPOSAL.

FOR CONSTRUCTING — RESURFACING — RECONSTRUCTING — A SECTION OF HIGHWAY IN THE TOWN OF .....  
 ..... **Southborough** .....  
 COMMONWEALTH OF MASSACHUSETTS.

## LOCATION.

The work referred to herein is in the Town of ..... **Southborough** .....

County of ..... **Worcester** ..... Commonwealth of Massachusetts,  
 and is shown by a set of plans and profiles, signed by and on file in the office of the Department of Public Works, Division of  
 Highways, and extends as follows: beginning .....

..... **at about station 0+0 said station being on the Marlborough  
 Road at the Marlborough Town Line and extending thence south-  
 erly for a distance of about 3700 feet to station 37+00.** .....

To the Board of Selectmen.

The undersigned, as bidder, declares that the only persons or parties interested in this proposal as principals are those named herein; that this proposal is made without collusion with any other person, firm or corporation; that he has carefully examined the location of the proposed work, the annexed form of contract, and the plans therein referred to; and he proposes, and agrees if this proposal is accepted, that he will contract with the Board of Selectmen, in the form of the copy of the contract annexed hereto, to provide all necessary machinery, tools, apparatus and other means of construction, and to do all the work and furnish all the materials specified in the contract, in the manner and time therein prescribed, and according to the requirements of the Engineer as therein set forth, and that he will take in full payment therefor the following sums, to wit:

Item Nos.	Basic Quantities.	Items with Unit Bid Price Written in Words and Figures.
1	3290	Cubic Yards "Roadway Earth Excavation", at ..... ..... <b>ninety cents</b> ..... (\$.....) per cubic yard.
2		Cubic Yards "Bridge Excavation", at ..... ..... ..... (\$.....) per cubic yard.
3	50	Cubic Yards "Ledge Excavation", at ..... ..... <b>two dollars and fifty cents</b> ..... (\$.....) per cubic yard.
4		Cubic Yards "Ordinary Borrow", complete in place (not including overhaul), at ..... ..... ..... (\$.....) per cubic yard.
5	26	Cubic Yards "Plain Concrete Masonry", complete in place, at ..... ..... <b>twenty dollars</b> ..... (\$.....) per cubic yard.
6	1	Cubic Yards "Reinforced Concrete Masonry", complete in place, at ..... ..... <b>forty dollars</b> ..... (\$.....) per cubic yard.
7		Cubic Yards "Reinforced Concrete Surfacing", complete in place (including all materials except reinforcement and dowels), at ..... ..... ..... (\$.....) per cubic yard.

Item Nos.	Basic Quantities.	Items with Unit Bid Price Written in Words and Figures.
8	2390	Tons of "Broken Stone", complete in place, at <u>Three dollars and fifty-five cents</u> (\$. 3.55) per ton.
9	27200	Gallons "Bituminous Material", complete in place, at <u>Fifteen and one-half cents</u> (\$. 0.155) per gallon.
10	52	Lineal Feet of "42 inch <u>REINFORCED CONCRETE</u> Pipe", complete in place, at (\$. 14.00) per lineal foot.
11	62	Lineal Feet of "36 inch <u>REINFORCED CONCRETE</u> Pipe", complete in place, at (\$. 10.00) per lineal foot.
12	140	Lineal Feet of "12 inch <u>REINFORCED CONCRETE</u> Pipe", complete in place, at (\$. 2.25) per lineal foot.
13	44	Lineal Feet of "12 inch <u>CORRUGATED IRON</u> Pipe", complete in place, at (\$. 2.00) per lineal foot.
14		Lineal Feet of ".....inch <u>Pipe</u> ", complete in place, at (\$. ....) per lineal foot.
15		Lineal Feet of ".....inch <u>Pipe</u> ", complete in place, at (\$. ....) per lineal foot.
16		Lineal Feet of "Fencing Used as Guard Rail", complete in place, at (\$. ....) per lineal foot.
17	2200	Cubic Yards "Stone Filling", complete in place, at <u>Two dollars and fifty cents</u> (\$. 2.50) per cubic yard.
18		"Delivering and Setting Bounds", complete in place, at (\$. ....) each.
19	3	"Catch Basins," as per plan, complete in place (including all materials except frames and grates), at <u>Ninety dollars</u> (\$. 90.00) each.
20	Extra Work	For "Extra Work", if any, performed in accordance with Article XVI, the amount provided for in Article XVI.
21		Pounds "Reinforcement and Dowels for Cement Concrete Surfacing," complete in place, at (\$. ....) per pound.
22		Tons "Bituminous Concrete Surfacing Type", complete in place, except seal coat (\$. ....) per ton.
23	2	"Curb Stone Inlets", complete in place, at <u>Thirty-five dollars</u> (\$. 35.00) each.

Item Nos.	Basic Quantities.	Items with Unit Bid Price Written in Words and Figures.
24		Lineal Feet of "Guard Stones", complete in place, at..... ..... (\$. ....) per lineal foot.
25		Lineal Feet "Removal and Rebuilding Stone Walls", complete in place, at..... ..... (\$. ....) per lineal foot.
26		Cubic Yards "Riprap", complete in place, at .....
		..... (\$. ....) per cubic yard.
27		Lineal Feet "Side Drains with.....inch Vitrified Clay Pipe", complete in place, at..... ..... (\$. ....) per lineal foot.
28		Lineal Feet "Side Drains with.....inch Vitrified Clay Pipe", complete in place, at..... ..... (\$. ....) per lineal foot.
29		"Removal of Trees (nine (9) inches or more in diameter)", at..... ..... (\$. ....) each.
30	2100	Cubic Yards "Gravel Borrow", complete in place (not including overhead), at..... <i>One dollar</i> (\$. 1.00) per cubic yard.
31	150	Cubic Yards "Sand Borrow", complete in place (not including overhead), at..... <i>Two dollars and fifty cents</i> (\$. 2.50) per cubic yard.
32	100	Cubic Yards "Stripping Gravel Pits", at Twenty cents (\$.20) per cubic yard.
33		Cubic Yards "Gravel Surfacing", complete in place (not including overhead), at .....
		..... (\$. ....) per cubic yard.
34		Cubic Yards "Reinforced Concrete Masonry for Bridge Fences and Posts", complete in place, at..... ..... (\$. ....) per cubic yard.
35		Cubic Yards "Rubble Concrete Masonry", complete in place, at..... ..... (\$. ....) per cubic yard.
36		Cubic Yards "Cement Rubble Masonry", complete in place, at..... ..... (\$. ....) per cubic yard.
37		"Leaching Basins", as per plan, complete in place (including all materials except frames and grates), at .....
		..... (\$. ....) each.
38		Lineal Feet "Stock Fence", complete in place, at..... ..... (\$. ....) per lineal foot.
39		Lineal Feet of "Timber Piles", complete in place, at..... ..... (\$. ....) per lineal foot.

Item Nos.	Basic Quantities.	Items with Unit Bid Price Written in Words and Figures.
40		Lineal Feet of "Concrete Curb Stone", complete in place, at..... ..... (\$. ....) per lineal foot.
41		Lineal Feet of "Stone Curbing", complete in place, at..... ..... (\$. ....) per lineal foot.
42		"Manholes", as per plan, complete in place (including all materials except frames and grates), at .....
		..... (\$. ....) each.
43		"Removal and Resetting Bounds", complete in place, at..... ..... (\$. ....) each.
44		Thousand Feet Board Measure of "Lumber Sheeting", left in place, at..... ..... (\$. ....) per thousand foot board measure.
45	q	Pounds of "Zinc Plates", complete in place, at..... ..... (\$. ....) per pound.
46	7400	Lineal feet "Reforming, Trimming and Rolling Shoulders", at..... ..... (\$. 05) per lineal foot.
47	1	"Town Line Post Removed and Reset" complete in place, at ..... ..... (\$. 10) each.
48	38	Lineal feet of "12 inch Corrugated Iron Pipe Removed and Relaid", in place, at ..... ..... (\$. 15) per lineal foot.

Item  
Nos.Basic  
Quantities.

Items with Unit Bid Price Written in Words and Figures.

The above prices are to include and cover the furnishing of all the materials (except as herein otherwise specified), the performing of all the labor requisite or proper, and the providing of all necessary machinery, tools, apparatus and other means of construction; and the doing of all the above-mentioned work in the manner set forth, described and shown in the specifications and on the drawings for the work, and in the form of contract.

Accompanying this proposal is a certified check payable to the order of the Town of **Southborough** for \$ **900**. If this proposal shall be accepted and the undersigned shall fail to contract as aforesaid and to give a bond in the sum to be determined as aforesaid with surety satisfactory to the party of the first part, within six days (not including Sunday) from the date of the mailing of a notice from the party of the first part to him, according to the address herewith given, that the contract is ready for signature, the party of the first part may, at its option, determine that the bidder has abandoned the contract, and thereupon this proposal and the acceptance thereof shall be null and void, and the aforesaid check shall become the property of the Town of **Southborough**; otherwise the said check shall be returned to the undersigned.

Signature of bidder R. H. Newell Co.

Business address..... *Woburn, Mass.*.....

Place of residence.....

Date.....July 26.....1926.

The full names and residences of all the persons and parties interested in the foregoing proposal as principals are as follows:

(NOTICE.— Give first and last names in full; in case of corporations give names of president, treasurer and manager, and in case of firms give the names of the individual members.)

The proposed surety company on the bond to be given is as follows:

Name: \_\_\_\_\_

Address of home office.....

Massachusetts address.....

The Commonwealth of Massachusetts

Town of Southborough

## CONTRACT.

Clause 1. — This agreement, made this twenty-seventh.....

day of July....., in the year nineteen hundred and twenty-six, between the Town of Southborough....., by the Board of Selectmen, party of the first part, and B. H. Newell Company..... a corporation, duly organized under the laws of the Commonwealth of Massachusetts and having a usual place of business at Uxbridge, Mass. party of the second part.....

Clause 2. — Witnesseth, That the parties to this agreement, each in consideration of the agreements on the part of the other herein contained, do hereby agree, the Town of Southborough..... for itself, and said B. H. Newell Company..... for itself..... and its..... heirs, executors, administrators, successors and assigns, as follows:

To furnish all equipment, machinery, tools and labor; to furnish and deliver all materials required to be furnished and delivered in and about the improvement and to do and perform all work in the construction — ~~resurfacing~~ — ~~reconstruction~~ of a section of highway in the town of..... Southborough.....

in strict conformity with the provisions of this contract and the notice to contractors and proposal and the plans and specifications approved by the Board of Selectmen. The said plans and specifications and notice to contractors and proposal are hereby made a part of this contract as fully and to the same effect as if the same had been set forth at length and incorporated in the contract.

Clause 3. — In consideration of the foregoing premises the Town agrees to pay and the Contractor agrees to receive as full compensation for everything furnished and done by the Contractor under this contract, including all work required but not included in the items herein mentioned, and also for all loss or damage arising out of the nature of the work aforesaid, or from the action of the elements, or from any unforeseen obstruction or difficulty encountered in the prosecution of the work, and for all risks of every description connected with the work, and for all expenses incurred by or in consequence of the suspension or discontinuance of the work as herein specified, and for well and faithfully completing the work, and the whole thereof, as herein provided, such unit prices as are set out in the accompanying proposal.

In witness whereof the said parties have hereto set their hands, the Town executing these presents by its Board of Selectmen, on the year and day above written.

By

Town of Southborough  
Francis D. Newton

Board  
of

Charles F. Chadd

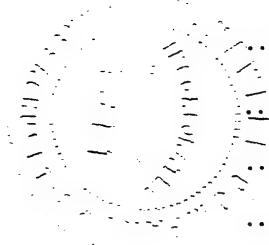
Selectmen

George F. Field

P. H. Newell Co.

E. Raymond Newell Trust,

Contractor.



## BOND.

Know all men by these presents,

That we

..... R. H. Newell Company, a corporation duly organized  
 ..... under the laws of the Commonwealth of  
 ..... Massachusetts and having a usual place of  
 ..... business at Uxbridge, Mass. .... as principal ,  
 and .....

..... The Metropolitan Casualty Insurance Company of New York, a Corporation duly organized under the laws  
 ..... of the State of New York, and having a usual place of business in Boston, Massachusetts. ....

..... as sureties, are held and firmly bound unto the Town of Southborough .....  
 ..... in the sum of Twenty-six thousand, eight hundred dollars (\$26,800.00.),  
 ..... to be paid the said Town of Southborough .., for which payment, well and truly to be made, we  
 bind ourselves, our heirs, executors and administrators, successors or assigns, jointly and severally, firmly by these presents.

The condition of this obligation is such,

That if the above bounden

..... R. H. Newell Company .....  
 ..... its ..... heirs, executors, administrators, successors and assigns, shall in all things stand to and abide by, and  
 ..... well and truly keep and perform, the covenants, conditions and agreements in the foregoing contract and any alteration thereof  
 ..... made as therein provided, for constructing a section of highway in the town of Southborough .....

..... on his or their part to be kept and performed, at the time and in the manner therein specified, and in all respects according to  
 ..... their true intent and meaning, and shall indemnify and save harmless the said Town of Southborough ..,  
 ..... its officers and agents, as therein stipulated, and shall also pay for all labor performed or furnished and for all materials used or  
 ..... employed in carrying out of said contract, then this obligation shall become and be null and void; otherwise it shall be and remain  
 ..... in full force and virtue.

In witness whereof we hereunto set our hands and seals on this Twenty-seventh ..... day of

July ..... in the year nineteen hundred and twenty-six

R. H. Newell Co ..... (Seal.)

E. Raymond Newell ..... (Seal.)

..... (Seal.)

The Metropolitan Casualty Insurance Company of New York .....

..... (Seal.)

Spencer J. Coffey ..... (Seal.)

..... (Seal.)

George C. Lusk ..... (Seal.)

..... (Seal.)

Signed and sealed in the presence of

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